THE

ELECTRICAL REVIEW.

VOL. LX. MAY 10, 1907. No. 1,537.

ELECTRICAL REVIEW.

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READY!

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1907 EDITION.

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LONDON'S ELECTRICITY SUPPLY.

THE Parliamentary Committee of the L.C.C. on Tuesday last reported to the Council on the policy to be followed in connection with the L.C.C. (Electric Supply) Bill, which was to go before the House of Commons for second reading yesterday. The Committee evidently found the matter one which could not properly be disposed of in the slap-dash way in which it was treated by the previous Council; so far, indeed, was it from arriving at a definite conclusion as to the modifications to be made in the terms of the Bill, that it recommended the Council to let the Bill go forward for second reading without waiting for the settlement of the questions under consideration.

It appears that the clauses relating to the compulsory purchase of the undertakings of the Borough Councils will be deleted, but that in all probability the provisions for the transfer to the Council of the powers of purchase vested in the Borough Councils over the undertakings of the existing companies, which in most cases mature in 1931, will be retained.

It is the avowed intention of the Committee that the Council shall not itself undertake the supply of electricity in bulk to the metropolitan area, but rather that an arrangement shall be made for the transfer of the powers to some company or other body, which will provide the necessary capital, and carry out the work under the Council's control. This policy is in accordance with the policy foreshadowed in our last issue, and, we believe, is the course best adapted to safeguard the interests of both ratepayers and consumers, while enabling justice to be done to the existing companies and providing for the utilisation to the greatest possible extent of the huge capital which has already been expended on plant and mains in a large part of the area concerned.

It is curious to note that, while the cases are not strictly parallel, there is, nevertheless, a considerable resemblance between the conditions of London and Paris as regards the supply of electricity. In both cases the business has been allowed to fall into a state of comparative chaos, though we, it is true, have never approached the climax attained by our *confrères*. In both cases, too, the muddle has been due largely to the intervention of the municipal authorities.

An amendment was rejected by the substantial majority of 74 to 39, and the recommendations of the Committee were adopted; the suggested alterations are to be submitted to the Council for approval at a later meeting. It was stated that the Committee had been in negotiation with three companies, but that no definite conclusions had been reached; further developments will be awaited with keen interest. It seems to us that unless considerable modifications are made in the terms of the other schemes put forward the chances are in favour of an arrangement being made with the existing companies.

Blast Furnace Gases and Electric Railway Operation.

AN article by Mr. F. E. Junge, in *Cassier's Magazine*, discusses certain economic problems confronting the iron industries of the United States. The rich ores of the Lake District are certain of exhaustion, their metallic content having decreased from 68 per cent. to 50 per cent. The undeveloped ore beds of the Western States are at present hampered by high freight charges and scanty fuel. As a means of reducing high

freight charges, the author turns to the internal combustion engine, coupled to electric generators, such engines using the margin of blast-furnace gas not required for heating the blast, or the margin of coke-oven gas not required for heating the retorts, together with the utilisation of very low grade waste coal from collieries in gas producers.

Mr. Junge dreams of a time when the iron industry will secure cheap freights. "If the iron industry would possess their own railroads for transporting their goods, or if iron-masters or owners of coke-oven plants and coal mines would even (as power producers) deliver electric energy to the railroads as consumers, they would control the situation of the iron markets, instead of having to part with their profits in order to reduce tariff rates."

Now, despite certain much-discussed failures of internal combustion engines, and also many disappointments which are not discussed, we believe in the future successful use of what is in Great Britain our only untapped source of fuel, and await with interest the fruits of the Act secured in 1906 for power distribution from this source in the Cumberland iron districts. But we must regard the wholesale electrification of long lines of rail as a dream whose realisation must be deferred for a long time to come. Mr. Junge seems to us to have overlooked both the heavy cost of electrifying long lines of railways—live rails or overhead conductors, locomotives, sub-stations and so forth, to say nothing of the poor load factor which any but suburban lines or main lines with very heavy traffic offer. The capital charges per ton-mile hauled for a heavy freight train would be greatly increased if one of the long single-track systems, so common in the States, were electrified. If a frequent service of light freight trains were employed, the wages cost of transportation would rise to a high rate. Therefore, we believe that it is in the United Kingdom and in Germany, rather than in the United States, that the waste gases of blast furnaces and coke ovens will find their chief utilisation outside the steel or iron works. Denser industrial areas, tramway services, the large adjacent manufacturing towns, and even British railway systems form a market which the British iron founder will be well advised to secure for the disposal of power from his surplus gases.

Copper Supplies.

Apart from artificial influence on prices, "substitute" rumours, &c., one naturally looks to the supplies of copper, in stock and afloat, to indicate the actual position and prospects of the market. A circular recently issued by Messrs. H. R. Merton & Co. gives a number of useful figures for the present and three preceding years, which show the increasing consumption of copper and the efforts of the producers to keep up with it. The stocks in England and France, including shipments afloat from Chile and Australia, on April 30th for the four years, show considerable variation. In 1904 there were 12,000 tons of this stock at the date named (France 2,000, afloat 5,400), in 1905 the stock had risen to 18,000, and in 1906 it had fallen to 9,000. The present year saw it up to 15,007 at the end of March, and at 12,958 on April 30th.

During 1905 the stocks were maintained high, and the shipments well up to the average, increasing in the latter part of the year, so that the exceptionally high stocks in April of that year cannot be attributed to undue holding of supplies. In the first four months of 1906, stocks had fallen to 9,000 tons, which would appear to indicate delay to the supplies afloat, accompanied by a strong demand. It is interesting to note that the supplies from North America to English and other European ports for the year ending April 30th, 1907, are only 2,000 tons better than for the preceding twelve months. Spain and Portugal have increased their export to England and France by 3,460 tons. The N. American figure is 193,800 tons, and the Spanish and Portuguese one 23,222, so that the proportion is much greater in the latter case. Chile shows a falling off in shipments to Europe and the United States, those for the last twelve months being 1,700 tons less than for the preceding year. The Australian figures are far and away the best reading, giving 34,200 for 1906-7, against 26,900 for 1905-6 and 16,500 for 1904-5. It is a legitimate deduction that the falling off in American supplies to Europe may be occasioned by the increased home demand, as evidenced by the re-importation from Liverpool to the States which has taken place for the last five months, 1,900 tons being disposed of this way in January, and smaller quantities up to the present time.

The total supplies for the three periods were 1907-6, 337,250 tons; 1906-5, 316,550; and 1905-4, 323,139, so that, although the price has been on the whole steadily going up, the stimulus of a really high value has not yet had time to take full effect. The shipments afloat from Australia at the present time (April 30th) are given at 4,000 tons, considerably the highest for this date for the four years, and surpassing any recorded in the monthly tables.

The general tenour of the circular appears to be that, of all the supplying countries, Australia has the most quickly responded to the call for increased output. America has, undoubtedly, made considerable effort in this direction, but the transhipments appear to indicate that demand is still above supply. Spain and Portugal are doing fairly well, but one would rather suppose the output to be incapable of great advance.

Economy Records.

A careful perusal of a paper read before the American Street and Interurban Railway Engineering Association, at Columbus, Ohio, by Mr. W. Goodenough, which is reprinted in our contemporary, the *Western Electrician*, will enable the reader to avoid the pitfalls and confusion liable to be engendered by a bad definition of rating and describing results with the use of double abscissæ. It is rather a curious development of this pictorial art, that whereas the original use of curves was to embody in one line the essence of a whole column of description, it has now become a common thing for curves to present a puzzle only to be solved by the earnest study of a page of letterpress. The compiler of the data for curves generally entirely ignores the laborious intermediate steps which resulted in obtaining data from which could be computed, say, "pounds of fuel per glow-lamp connected." As a consequence, allusion to intermediate processes of reasoning is entirely omitted from the thesis in its final form, so that the reader's or hearer's only chance of extricating results from a maze of lines is by lengthy reconstruction of each step, tempered by a telepathic insight into the author's mind.

But having protested against the author's diagrammatic methods, we have yet more to say against his comparative methods, which are based upon that very fallacious factor, the manufacturer's rating as to capacity. We have known cases in which identical generating sets have been sold to two different purchasers, in which the nominal full-load capacity to A, who demanded a 50 per cent. overload for half an hour, was 20 per cent. less than for the machine sold to B, whose demands as to overload were less strict. We would, therefore, follow Dr. Stodola's lead, and urge that for comparative purposes the full-load capacity should invariably be reckoned as that at which the most favourable steam consumption is afforded. As Mr. Walter Goodenough has not plotted his curves upon this basis, but compares, in one instance, a reciprocating set using saturated steam with its lowest steam consumption at 85 per cent. of its rating, and a turbine set having its lowest steam consumption at 135 per cent. of its rating, and in another instance compares the reciprocating set at 105 per cent. of its rating with the turbine set again at 135 per cent., we must refrain from discussing his figures. We concede, of course, that operating charges, together with the element of prime cost and behaviour of appurtenances, require consideration, but unless the base consideration as to rating is sound and equable, confusion of mind will only become the worse confounded in regard to a question demanding clear thinking.

BALANCERS.

By WILLIAM H. TAYLOR, A.M.I.E.E.,
Walthamstow Electricity Works.

DIFFICULTY is experienced in some three-wire stations with the balancers of the so-called automatic type.

The question of regulation comes up when a new machine is being installed, and what manner of winding should be adopted, so that loads up to 75 per cent. of the full capacity of the machines can be dealt with, while maintaining the pressure on either side of the system constant. In fig. 1 the connections are shown of one type of so-styled automatic

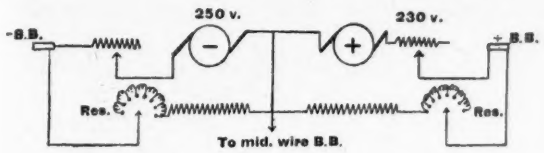


FIG. 1.

balancer. This machine, as it is connected, will not tend to equalise the voltage, unless the field regulators are worked so as to cut in or out the resistance; this arrangement may have certain advantages, but is by no means self-regulating. If the volts rise on the positive side, so does the current in the field, consequently the motoring effect is similarly reduced; on the generating side, the current in the field is reduced, which tends to make the machine generate a less pressure, or give no current to the more heavily loaded side. By cross-connecting the fields, as in fig. 2, the effect will be

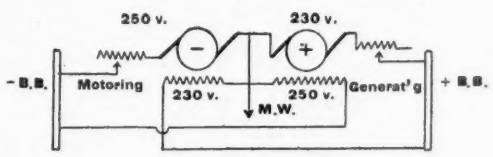


FIG. 2.

very much better, because in this case the motoring side will have its fields excited from 230 volts, and across the armature there will be 250 volts, and the speed will increase. On the generating side the fields are excited with 250 volts: consequently the machine will give current to this side, and by so doing raise the volts.

But machines of this type do not show great things in keeping the pressure constant, and this can only be done by winding the machines with a compound winding, connected in either of the following ways. Fig. 3 shows an ordinary compound-wound balancer.

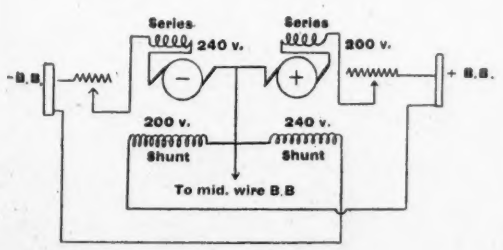


FIG. 3.

This class of machine is in use in many three-wire stations, but my experience has been that, should a short-circuit or earth take place, say, on the positive side, the machine on the negative side will at once commence to motor, and the result will be more trouble due to the balancer fuses or circuit-breakers operating. The current in the series winding of the negative machine will be in the opposite direction to the shunt, and if the short is a heavy one, it may reach such a value that it will so weaken the fields, due to its opposing the magnetic field set up by the shunt, that the machine will tend to race. When this begins the generating side gives a current which still increases the motoring side, and in a few minutes the fuses blow, or a flash-over takes place at the commutator. These are not imaginary, but actual occurrences which have taken place with machines connected in this way.

Fig. 4 shows another compound machine, but the series coils are connected in circuit with the middle wire. This machine suffers from the same ill effects due to a short of any magnitude; but in ordinary working it is far superior to the plain cross-connected shunt machines.

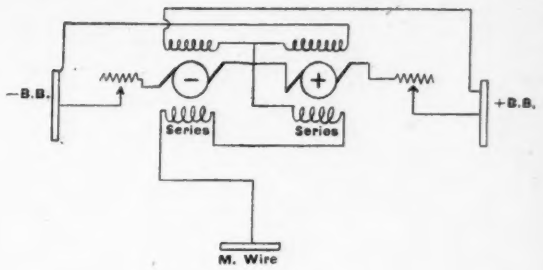


FIG. 4.

The most satisfactory arrangement of connections for a balancer, and one which gives freedom from the ill effects of a short to which the other machines are liable, is given in fig. 5.

It will be noticed that the series coils are cross-connected, as well as the shunts; the 100 amperes of the motoring side are passing round the series coils of the generating machine, with the shunt in the same direction, giving a very strong field. On the motoring side, the 60 amperes given out by the machine which is generating are passing round this machine's fields, but in the opposite direction to the shunt,

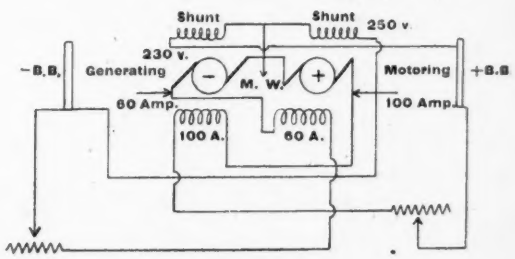


FIG. 5.

which will tend to keep the speed constant, and prevent the machine from racing, because this current can never rise to a higher value than the motoring armature current. If both currents are of equal value the speed will remain constant. These connections have been found to give every satisfaction, and make the machines regulate the pressure on either side to 1 per cent. of their full-load capacity. This is very good when middle-wire currents of from 100 to 350 amperes are being dealt with, in cases of shorts or earths taking place on the mains. These machines operate quite automatically, either in the main station or in an outlying sub-station.

The balancer question, to my mind, does not seem to have received the attention that it should have had in regard to central station work; some of the machines are simply ordinary shunt-wound dynamos coupled together. How engineers expect these machines to operate from no load to full load without any fall of volts taking place, it is very hard to see. Balancers should be machines designed for this one duty, and not stock machines, which would be sold for ordinary dynamos, and whose fields would require adjusting when the full load was thrown on and off.

I trust these few remarks will throw some fresh light on this important branch of central station work.

D

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Electric Thermal Baths.

Messrs. O. C. Hawkes, Ltd., have just issued a new publication (Bulletin B5) which deals with their electric thermal baths. The electric thermal bath is, of course, not a new article, but Messrs. Hawkes claim to have applied to it their patent induced-draught system of electric heating, with which our readers are already familiar, in a very effective manner. It is a direct air heating and air circulating system, and is claimed to be particularly well adapted for the purpose, as it supplies a constant current of hot air without the slightest admixture of any impurities and without combustion. Light is not employed. The patent induced-draught bath is primarily intended for employment in the bathroom of any house which has an electrical equipment. The accompanying illustrations show the thermal bath cabinet open ready for use, fig. 1, and folded for packing or stowing, fig. 2. The publication before us contains general notes of interest relating to thermal bathing, the advantages of electric baths, the skin and its duties, how to use the bath, etc.

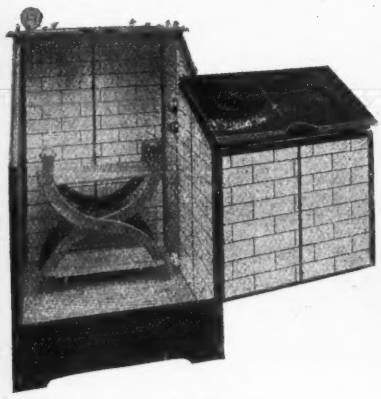


Fig. 1.

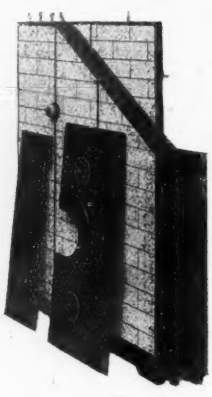


Fig. 2.

Eckstein, Heap & Co.'s Switches and Fuses.

We recently paid a visit to the large factory which Messrs. Eckstein, Heap & Co. have during the last twelve months been busily engaged equipping at Waverley Mills, St. Simon Street, Salford. A considerable outlay has been incurred in the up-to-date planning and equipment of these works with modern machinery for the manufacture of switchgear, fuses, instruments, fittings, &c. Among their many other executed contracts may be mentioned switchgear work for the L.C.C. tramways department and for cotton mill installations.

We now illustrate a few examples of the firm's special lines, which are new and improved patented designs.

In fig. 3 is shown an ironclad switch suitable for circuits up to 600 volts, which has been specially designed to occupy small space. It has a laminated brush of H.C. copper, provided with an auxiliary copper sparking finger, and final carbon break, mounted on a substantial lever, provided with a positive quick-break action. The two poles are mounted on separate slabs, which are insulated from the case by ebonite bushes. The handle can only be left in the full "on" and "off" positions.

Fig. 4 represents their D.P. ironclad main switches with fuses, for similar voltages. The switches are of the above standard laminated brush type, and the fuses are of the enclosed Noark type, and are shielded from the poles of the switch by means of asbestos slate barriers. By using this combination of switch and fuses, it is claimed that a considerable saving is effected in the cost of connecting up, and that space is also saved.

The firm's ironclad house service fuse-boxes (see fig. 5) have as their special features simplicity of construction combined with mechanical design (the shape of the insulators is such that they slide into position and are held there by external milled head screws, thus obviating the use of cement); the ease with which the cables can be soldered into the socket, owing to the above method of fixing; high insulation, owing to the shape and method of fixing the porcelain insulators; and rapid replacement of fuses. They are supplied either single-pole boxes, asbestos lined, for open type fuses for circuits up to 600 volts, or for closed Noark fuses, 250 and 600 volts. Fig. 6 illustrates the patent porcelain handle switch fuses for voltages up to 600. In these fuses, the contacts are held mechanically in position, thus obviating the use of cement. For capacities above 100 amp. separate wires are used for each additional 100 amp., each wire being contained in a separate asbestos tube. This reduces the mass of molten metal in any one tube, thereby preventing the bursting of the porcelain tube when the fuse blows. A guiding plate is fixed at each end, which ensures the fuse being located correctly in the contact jaws. It may be emphasised that both in the fuse-boxes shown and in the replacement handle fuses, the use of cement is obviated by special mechanical arrangements.

Fig. 6.

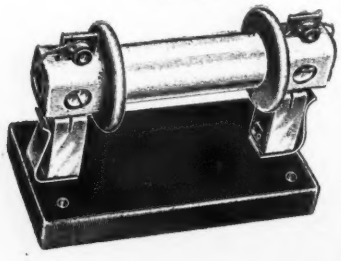


Fig. 3.

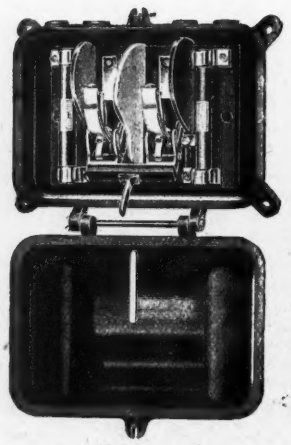


Fig. 4.

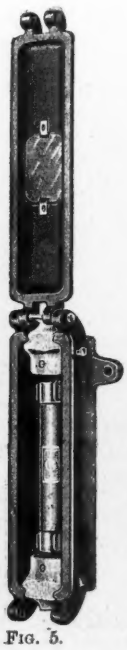


Fig. 5.

Grinding and Buffing Motors.

The Armorduct Manufacturing Co., Ltd., whose "Little Hustler" drills and grinders are already known to our readers, have issued an illustrated list of their grinding and buffing motors for 220 volts direct and three-phase current, pedestal type. One of these appears in fig. 8. The totally enclosed motor is fitted with a double-ended shaft, which admits of the fixing of the ordinary emery wheels or polishing bobs, thus giving a useful combination. The outfit is self-contained, and occupies very little space. The starter and switch which actuate the motor are contained in the socket or pedestal on which the motor is mounted.

In fig. 7 we illustrate the electro-magnetic hold-on applied in connection with the "Little Hustler" variable speed drills, for adapting certain types of drills for continuous working, and in particular for the drilling, in horizontal positions, of steel and iron plates, &c. This apparatus is in the form of a powerful horse-shoe electro-magnet, between the poles of which the drill, together with screw-hand feed, is fixed. Two adjustable supports are

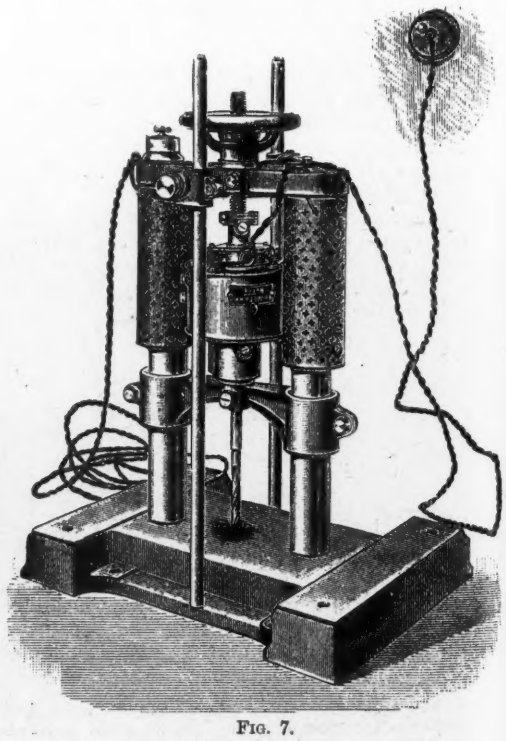


Fig. 7.

provided to prevent tilting, and to admit of adjustment. Where it is possible to suspend the apparatus, it may be used for vertical work. The magnetic circuit is applied immediately the current is switched on, so that the article which it is intended to drill is brought firmly into contact with the pole-tips of the hold-on.

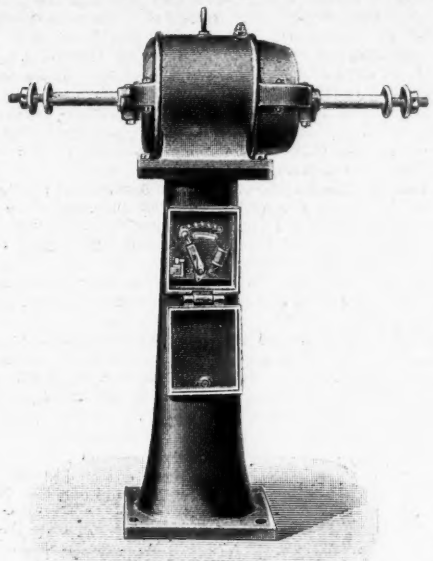


FIG. 8.

As in the case of ordinary breast, angle-post or bench drills, the current is supplied to the machine by a flexible cord connection, which, by the use of an adaptor, is attachable to any ordinary lamp-holder, or it may be attached to the ordinary two-pin plug base. The Armorduct patent automatic overload cut-out is attached, and the tool is by that means made fool-proof.

Fuse Tests at Deptford.

Some interesting fuse tests took place at the Deptford Generating Station of the London Electric Supply Corporation on Friday, May 3rd, when a series of short circuits was made across a 500-KW. 550-volt set with various sizes of special "Koolark" fuses, made by the ELECTRICAL APPARATUS CO., of Caxton House, Westminster.

The fuses were in turn connected to the 'bus bars by means of short stout cables, the only other apparatus in circuit being a switch and a circuit-breaker set at 3,500 amps. Each fuse was then switched dead across the generator. The momentary surge of a short-circuited 500-KW. set may be estimated at about 2,500 H P., so that the fuses were tested under exceedingly severe conditions.

In every case the fuse acted instantaneously, without explosion or appreciable noise, and until the generator attendant was notified of the fact, he was unaware that the tests were taking place.

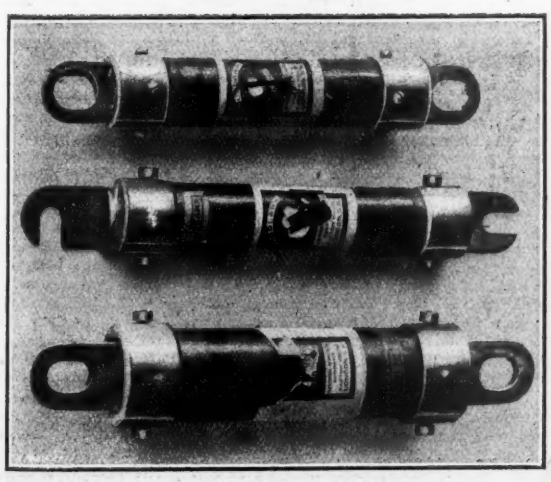


FIG. 9.

These excellent results were attained with the "Koolark" patent, by means of which a cooling fluid is set free at the moment of the short circuit, and, with the help of a special filling which has the peculiar characteristic of liberating moisture at a high temperature, instantaneously cools and condenses the products of the arc.

These tests, we are informed, constitute a unique record, as the London Electric Supply Corporation has from time to time tried every other fuse on the market, but hitherto no fuses have been able to stand the severe conditions without exploding.

The fuses tested ranged from 50 to 100 amps. rating, at 550 volts. A slight flash and a slight noise were observed in two only out of the five tests; none of the fuses exploded, or was mechanically injured beyond the extent shown in the accompanying illustration (fig. 9). The circuit-breaker did not open in any of the tests, and the generator showed no sign of injury.

The tests were made in the presence of Messrs. Feetham and Ellis, of the London Electric Supply Corporation, and Mr. Amberton, of the Electrical Apparatus Company.

Alternating-Current No-Voltage Circuit-Breaking Apparatus.

It has often been desired to have an apparatus suitable for alternating-current circuits which should open such a circuit on the failure, or excessive lowering, of the supplied voltage. Such apparatus has usually consisted in the past of an electromagnet excited by a shunt coil fed by the supply. When the voltage falls, or fails entirely, the armature of the said magnet falls away and opens the circuit-breaker. The great disadvantage of this form of apparatus is that, on a sudden and momentary failure of the supplied voltage, the cut-out operates. This is very inconvenient, as the following example will show:—

Suppose a number of motors are supplied from a network which is fed by a feeder having considerable length. Each motor is protected by a no-voltage release. If now a short-circuit occurs on the network, causing the fuse to blow on the same, or one of the motors is started up too quickly, a very large rush of current occurs which, owing to the resistance of the main, causes a momentary drop of

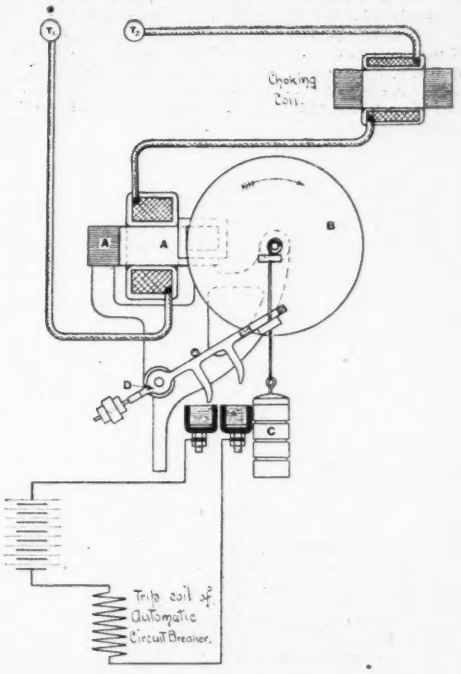


FIG. 10.

voltage in the network. Should the motors be equipped with the usual form of no-voltage release, which operates instantaneously all of them will be cut out of circuit.

A new form of no-voltage release, designed by Dr. C. C. Garrard, has been put on the market recently by MESSRS. FERRANTI, LTD. and is illustrated in fig. 10. In this no-voltage release the disadvantage of the usual form is obviated by combining with the no-voltage release mechanism a time element.

Referring to fig. 10, the release consists of a shaded-pole electromagnet A. This shaded-pole electromagnet is energised by a shunt circuit connected across the mains, or to the secondary of a potential transformer connected across the mains.

Between the poles of the shaded-pole electromagnet a metal disk B is pivoted. It is so arranged that when the coil on the electromagnet is energised by the supply voltage, the disk rotates and winds up a suspended weight C. The string to which the suspended weight is attached has two stops fastened to it, one above and one below a slot in a pivoted lever D; this lever carries contacts which, when the weight is in its bottom position, come against two fixed contacts and complete an electric circuit between them. The completion of this circuit causes current to flow round a trip coil, which is adapted to cause the controlled circuit-breaker to open circuit. When the supplied voltage is at its full value, or above a certain minimum, the rotatable disk will keep the suspended weight in its top position, and thus contact is not made between the two fixed contacts. When the supply voltage, however, falls below a certain minimum, the suspended weight is too large to be held up with the reduced voltage; thus, it begins to fall, and when it reaches the bottom of its travel, contact is made between the two fixed contacts and the switch is open-circuited. It will be

seen that when the weight is wound right up, the bottom projection on the supporting string engages on the bottom side of the pivoted lever. When the weight is in the bottom position, the other projection on the string engages on the upper side of the pivoted lever. The time taken by the weight to fall gives the time element, as contact is not made between the fixed contacts until the weight has fallen to, or nearly to, its bottom position.

The current required to operate the trip coil is preferably taken from some other source, which remains unaffected when the supply voltage falls. In some cases, however, the current for working the trip coil could be taken from a current transformer included in the same circuit as the controlled apparatus. In this case, the trip coil would be normally short-circuited by the pivoted lever; and this short circuit would be removed when the time element had elapsed after the supplied voltage had fallen below the fixed minimum.

A number of relays of this type have been sold already by MESSRS. FERRANTI, LTD.

PARLIAMENTARY.

Lancashire and Yorkshire Railway Bill.

ON May 2nd Sir Lewis M'Iver's Select Committee of the House of Commons considered this Bill, which, amongst a number of other things, asked for power to increase the span or make additional arches or openings on the north side of the bridge carrying the Crosby Road over the Liverpool, Crosby and Southport Railway.

Sir R. LITTLER, K.C., who appeared for the company, said that there was at Crosby Road a curve with a radius of only 23 chains, and Major Druitt, of the Board of Trade, attributed the accident which occurred there in 1903, when 7 people were killed and over 100 injured, to the excessive speed at which the train travelled over that curve, and recommended that in future a speed not exceeding 25 miles an hour should be observed. While the company did not admit Major Druitt's conclusions, they wished to allay public apprehension and to flatten the curve.

Mr. D. C. RATTRAY, chief engineer to the company, was called to bear out counsel's opening statement.

Mr. ACWORTH, on behalf of the Waterloo and Seaforth Urban District Council, contended that it was within the power of the Committee to lay the company under an obligation to deal with the existing level crossings on the line. At present there were three level crossings, and the local authority were willing to contribute to the cost of substituting bridges.

Sir RALPH LITTLER objected to anything of the kind being introduced into the matter, as this was purely asking for power to do a certain thing, and there was no question of level crossings before the Committee.

The CHAIRMAN said they would allow Mr. ACWORTH to cross-examine witness as to whether there was anything behind the proposal.

In reply to Mr. ACWORTH, WITNESS said that now the railway was electrified there were a larger number of trains running. He believed that the company did not go to Parliament to get powers to electrify the railway. He did not know whether the local authorities went to the Board of Trade and asked them to interfere, or whether the Board of Trade declined to do so because they were doubtful as to whether the railway company had got legal powers.

The CHAIRMAN said the Committee would certainly not go into the question of whether the electrification was legal or not.

Mr. ACWORTH said that his point was that in this particular matter the local authorities had had no opportunity of coming before Parliament. He put it to witness that there was more danger at the level crossings with a frequent service of electric trains than there was with the infrequent service of steam trains.

The CHAIRMAN said the Committee allowed the cross-examination to enable Mr. Acworth to find out from the witness whether the company had some nefarious scheme for widening the line.

In further cross-examination, WITNESS said that it was quite true that the railway company had acquired land along either side of the railway, and possibly at some future time this might be used for widening. It had not been bought with that express purpose, but only in accordance with the general policy of railway companies to purchase such land. He knew of no contemplated scheme for widening the line.

Mr. ACWORTH: You would agree that a level crossing with four tracks of electric rails would be terrible?—No. I do not know that I would admit that.

A Member of the Committee: Is there any more danger to the public at level crossings on an electric railway than on any other railway?—No, none whatever. The conductor rail stops some distance from the crossing, and the current is continued underground.

Further questioned, WITNESS said the object of getting rid of the curve was to do away with the speed limit, but the first of the level crossings was some distance away.

Local evidence was then called by Mr. Acworth as to the feeling in the district for the abolition of the level crossings.

The Committee found the preamble proved, but the Chairman expressed the view of the Committee that the railway company and the local authority ought to come to some mutual arrangement for the substitution of bridges for level crossings.

Radio-Telegraphic Convention Committee.

SIR J. DICKSON POYNDER presided over the sitting of the Committee on Tuesday, April 30th.

Mr. OWEN PHILLIPS, M.P., chairman and managing director of the Royal Mail Steam Packet Co., said that the steamers of his company fitted with wireless telegraphy were those of the West Indies, the Central American and New York services. They had adopted the De Forest system because it inter-communicated with other systems in that district. They had ceased to carry operators on their boats running to England, because they could not communicate with any of the coast stations here. He advocated the adoption of the Convention in the interests of the mercantile marine, and he also looked to the relief of Lloyd's and the Admiralty from their obligation not to inter-communicate if the Convention were ratified. His company had been in negotiation with the Marconi Co. to fit the River Plate ships with apparatus, but so far this had not been done, because of the difficulty they had in not communicating with other systems.

Mr. GWYNN said, if the Convention were not ratified and licences were granted for other stations on the south coast, that would meet witness's point.

WITNESS said it would not get over the difficulty altogether, because they still would not be able to communicate with Lloyd's.

In reply to questions as to whether he thought, if the agreement between Lloyd's and the Marconi Co. were violated, compensation should be paid to the company, WITNESS said it was a legal question, but in his opinion, of course, no agreement should be violated without compensation.

Mr. MARCONI was called, and said his first experiments were carried out on his father's estate in Italy in 1895 and 1896, where he found by various devices which he patented in England in 1896, that he could obtain signals over a distance. He came to England and carried out a number of experiments in the Post Office buildings, and, later, on Salisbury Plain, where he signalled over a distance of 1¾ miles. After that the Post Office asked him to carry out extensive trials in South Wales, where he signalled over a distance of 9 miles. He obtained no financial assistance whatever from the Post Office. He confirmed the evidence of Mr. Cuthbert Hall, that Prof. Slaby saw the whole of his apparatus, and was now manufacturing it. He considered that this was an infringement of his patent. His first English patent was applied for on January 2nd, 1896, and was accepted in July, 1897, and Sir Oliver Lodge's first patent was applied for in May, 1897, and accepted August, 1898. He had some technical objections to the ratification of the Convention, which, he contended, in its present form would seriously impede the progress of wireless telegraphy. The Convention assumed the possibility of intercommunication between various wireless telegraph systems entirely based on the system of wave lengths, leaving out the question of amplitude. Before communication was effected, it must be understood that waves must be of a certain definite amplitude. These technical considerations were of the greatest importance, and the Convention seemed to be formed on the hypothesis that all systems of wireless telegraphy, whether present or future, should be cognate systems, and that it would be easy to graft one on to another. A great number of systems would not be able to intercommunicate at all. The Convention seemed to think that the question of intercommunication was based on wave lengths. He contended that it was based on other considerations which the Convention had not considered.

In what way will the discretion with regard to the use of amplitude lead to confusion?—Suppose I have got a system now which uses continuous waves of small amplitude, and I think it desirable to adapt it to certain ships, then those ships are not able to intercommunicate with the ordinary big waves.

The CHAIRMAN: You are only apprehensive that there may be difficulty in its being put into effect, but you realise that it is provided for?—It is provided for, but I think it will be a difficulty.

Mr. GWYNN: If the object of the Convention is to establish general intercommunication, the Governments who made the Convention may impose the use of amplitude which will permit of intercommunication?—Yes.

The primary object of the Convention is intercommunication, although from the scientific point of view it may be more desirable to use a system that will not intercommunicate?—Yes. What I contend is that if science advances in the way which I believe it will, those systems which cannot intercommunicate, instead of becoming the exception will be the rule.

Mr. BUXTON: The spark systems will intercommunicate, but they cannot intercommunicate with continuous systems. Continuous systems will communicate between one another, and therefore if they become the predominant system, they will carry out intercommunication?—Yes, but I go further; there are other systems which are being experimented with now which will not intercommunicate with either continuous systems or non-continuous systems.

Mr. LEE: What system are you referring to?—A system of my own. The patent has been applied for.

Mr. GWYNN: Although there is a section in the Convention which permits the working of exceptional systems which will not intercommunicate, the general object of the Convention is to enforce intercommunication, and you are therefore afraid that the Governments which have made this Convention may discourage the use of systems which do not permit of intercommunication, and in that way impede the advance of science?—Yes.

On the other hand, if you have a system which does not intercommunicate, and that becomes almost world-wide, would not that discourage the progress of science because of the authoritative position it would hold?—I think other systems should have a good

chance to establish their superiority by installing stations and working ships.

Mr. BUXTON: You would be willing that the Post Office give them licences on the Channel coast, so that they may have free opportunity of competing with the Marconi Co. ?—That is a question for the Government. I would not object.

The CHAIRMAN pointed out that there was a clause in the Convention which said that the Convention did not prohibit other systems, even if they did not intercommunicate.

WITNESS replied that he would imagine that, with the high feeling between European Governments, such applications would not be granted.

Questioned by the CHAIRMAN as to his further objections to the Convention, WITNESS said it made no reference to the method by which messages could be directed mainly in a certain direction, or by which land stations could receive messages from ships in different bearings without interference, although the ships might be using the same wave lengths. Further, he concluded from recent experiments that the limitation of power to 1 KW. for ship transmission was unnecessary. He did not understand why vessels should not be able to send messages over the same distances as they received them. If a ship received a message over 1,000 miles, it would be a great thing that it should be able to reply to that message, and he believed that the true methods might be developed sufficiently to prevent interference.

Mr. BUXTON pointed out that the clauses in the Convention meant that a ship did not require more power. It distinctly said that more might be used if it were necessary.

WITNESS said the Convention also did not provide for the carrying out of experiments on board ship. Certain conditions were specified which would render it impossible to carry out experiments. He referred to Article VI, *a*, *b*, *c*. His objection was that it would place obstacles in the way of carrying out experiments on board ship, and it was impossible to overrate the importance of the free use of ships in the mercantile marine in carrying out tests.

Mr. BUXTON said that Article I referred to those stations which were open to the service of the public, and it did not apply to any station which was in an experimental stage, or used for experimental purposes. He understood that witness's point was that experimental stations were shut out by those regulations. But these stations were practically outside the Convention altogether. The only stations involved in the Convention were those which were actually open to public correspondence.

WITNESS said he understood that under the Convention there was no provision for experimental stations.

Mr. BUXTON said that would come under Article 7. He did not think there was really anything in witness's point.

The CHAIRMAN: What do you consider the position of England will be if it is not ratified?—My humble opinion is that England, by standing out from the Convention, has everything to gain and practically nothing to lose.

Mr. BUXTON: England or the Marconi Co. do you mean?

WITNESS said he was speaking of England. Take the matter of wave lengths, for instance. If England did not ratify the Convention and all the other nations did, then was it not a fact that while the latter would conform to certain wave lengths, England could do what it liked. He was entirely in favour of free competition between systems, and he feared that the working of the Convention would not allow of free competition, because it would bind down systems to certain wave lengths, and also enforce intercommunication and co-operation between competitors. He thought from what he had seen of the evidence of Sir Oliver Lodge, that he agreed with him on that. He also apprehended a difficulty in detecting the source of error if such error took place. He doubted whether the blame would be accepted by the Government who licensed the ship, should their operator be guilty of error. Witness said he wished to refer to the document which Mr. Gavey, of the Post Office, put in, showing the wireless telegraph stations of the world. In that return, Russia was not credited with any Marconi system at all, but, as a matter of fact, the Marconi Co. had supplied 48 complete stations to Russia, and it was rather strange where they could have gone to. As to China, the return said there were three stations on his system. The Italian Government had installed all the stations on his system in China, and informed him there were five such stations. Then they had a station in the Argentine Republic which was not marked, and there might be other omissions. A great many of the stations credited to America had nothing to do with the Convention. They were stations set up for communication between such towns as St. Louis and Denver, while others were put up to advertise different systems.

The CHAIRMAN: You have raised many points of objection with regard to the Convention, but I think it is not so much that the Convention has ignored these points, but that you are apprehensive that they are unworkable.

WITNESS said his chief feeling was that commercially the Convention was not fair, and secondly, that the technical difficulties in carrying it out would militate against its practical application. Further, he thought that it would restrict the scientific development of systems. His company had been advised that inter-communication with another company was an infringement of their own rights, and he thought that the Convention, if it came into force, would inevitably lead to a vast amount of litigation. His company contended, on the best authority, that other systems comprised certain features of his system, and was a violation of his right. All the other systems, they were advised, did use some elements of his system, and it seemed that a whole vista of litigation was before them which they had not undertaken already, because their interests were not sufficiently affected. They would, however, have to undertake that litigation if this Convention came into operation.

It had been said that the company were already intercommunicating with other systems, but at the same time the lawyer said they must protect their patent rights.

The CHAIRMAN: The protection of your patent rights was the sole reason for your opposition to the Convention?—No. I have stated other reasons in my evidence; that is one of the many reasons.

Replying to questions by Sir GILBERT PARKER, Witness said he had discussed the question on various occasions with Colonial ministers in their own countries, and they agreed that intercommunication was not practical, and agreed to the provision of non-intercommunication. The Colonies he had dealt with so far were not anxious to have intercommunication.

Mr. SYDNEY BUXTON: I understand that the relations between the Post Office and yourself have been of a friendly character?—Yes.

And therefore when it is said that the Marconi Co. have been badly and unjustly treated, and that there have been strained relations for many years, it is not true?—There have been friendly relations between myself personally and the Post Office. At that time there was no Marconi Co.

Do you allege that there have been strained relations between the Post Office and the company?—I have had nothing to do with those relations. I think on several occasions the company have found fault with the attitude of the Post Office towards them.

The Committee then adjourned.

Coventry Corporation Bill.

THIS Bill came on Friday before Lord Ribblesdale's Select Committee of the House of Lords. The Bill as first deposited dealt exclusively with water, but an additional provision was subsequently included by which it was proposed to extend the area of supply of electricity in the rural district of Coventry, the parish of Stivichall and the parishes of Allesley, Coundon Hamlet, Stoke Foleshill and Exhall. The provision also amended Clause 39A in the original Bill, and stated that in calculating the amount which the Corporation might borrow under the Public Health Act, 1875, any sum which they may have borrowed, or which they may hereafter borrow, for the purposes of their electric lighting undertaking, shall not be reckoned.

The Leicestershire and Warwickshire Electric Power Co., who were represented by Mr. Hutchinson, opposed the Bill.

Mr. VESEY KNOX, in opening, said that the electricity undertaking was first started in 1896, and it had had a remarkable history. It was a decided failure for the first few years of its existence, and there was a loss on every year's working. At the end of that period a new manager took charge of the undertaking, and induced the Corporation to entirely change their policy in dealing with the matter. The Corporation had only laid mains which were absolutely essential, and had not pressed the supply. The new manager in 1901 told them that if they were to double their capital, they would treble their supply, and so it had proved, for from a loss of £2,254 on the undertaking in 1901, the Corporation prospered so much, that in 1907, after paying all capital charges, with interest on the sinking fund, they had a profit of £5,506. The number of units sold was even more remarkable. In 1901 they were 341,000, and for 1907 3,950,000, so that under the new management the output had been multiplied, during the five years, more than 12 times. Together with the increase in the output, there had been a corresponding decrease in the price. They had brought down the average price of private lighting to 3·59d., and for power purposes to just over 1d., and they had been able to do the street lighting for nothing—one Committee had sold it to the other Committee for nothing. The profits were such that they could pay a dividend of 9 per cent. That was, of course, before paying all charges and interest on sinking fund, which would probably absorb 6 per cent., but the figures showed that the undertaking was a profitable concern. The business had increased to such an extent that they came there to ask Parliament to grant them additional borrowing powers to enable them to extend their station, and thus cope with the demand. It was not a problematical venture; the demand for the electricity was already there, for large manufacturers in the district were asking for the electricity. The Corporation were, however, faced with the difficulty, that money for electricity purposes were reckoned under the Public Health Act, and they could not borrow money to the extent of more than two year's assessable value of the town. Coventry had nearly reached that limit, and they asked Parliament to extend their borrowing powers. They proposed to supply five districts outside Coventry, and they had obtained the local authority's consent in each case. It had also been proposed to supply two other parishes, but not having been able to obtain the local authority's consent they had dropped the proposal. The only opposition to the Bill was that of the Leicestershire and Warwickshire Electric Power Co., a company with a long name, vast powers and no performance. That company had really done nothing, although they got their Parliamentary powers in 1902. They had not got a single customer, and all they had done was to erect a so-called generating station, with no generating machinery, and it was in a very dilapidated condition. The station was 12 miles away from the area which the Corporation proposed to supply. The company had already had one extension of time, and they had promoted a Bill—which, he understood, had been abandoned—for a further extension of time, and asking that, as they could not easily find the capital they should be allowed to raise the money in a particular manner. They certainly had a *locus standi* to oppose the Bill, but he thought it was an abuse of it to come there and oppose the Corporation's application when they themselves had done nothing to carry out their own undertaking as

authorised in 1902. Dealing with the company's petition, counsel said that if the company could supply current at a cheaper rate the Corporation was not stopping them. Other authorities had been granted competitive powers with companies, and he submitted that it was a great hardship if the manufacturers and traders in the district were to suffer, because a company which had already been granted powers and had done nothing to put them into operation, came to Parliament and opposed the application.

On Monday Mr. WEST, chairman of the Electric Lighting Committee, was called, and gave evidence bearing out the statements of counsel. He said the capital outlay on the electricity undertaking in 1906 was £152,000, which was twice the amount of capital expended in 1901. The Local Government Board last year sanctioned the borrowing of £31,000, but they required another £20,000 to meet the present demands for electricity. He understood the Leicestershire and Warwickshire Co. were not opposing the Corporation's proposal to borrow more money, but the proposal to supply the area outside the city. With regard to the letter sent by the Power Co. offering to supply the Corporation with energy, his Committee did consider it, but as the company had practically done nothing to put its powers authorised in 1902 into operation, the Corporation had declined the offer.

Cross-examined by Mr. TYNSLEY JONES, WITNESS said the Corporation had expended about £200,000 on capital expenditure. In addition to the £20,000 for immediate purposes, they would also require about £185,000 to meet the possible requirements of the next five years. Of the £31,000 sanctioned, about £27,000 was already absorbed. Their Committee had been unable to supply manufacturers for four months after the application, owing to the large demand and their inability to cope with it, and therefore they required more money, so as to extend the generating station and thus be able to meet the demand.

Mr. J. A. JECKELL, manager of the electricity undertaking, said the capacity of the generating station was 1,500 KW. in 1901. During his few years connection with the Corporation, the undertaking had undoubtedly proved a success. They had sold for all purposes in 1901 341,000 units, and they made a profit, after paying all capital charges, of £2,250. In 1906 they sold for private lighting purposes, 636,000 units at an average price of 3¼d per unit, and 3,211,000 units for power purposes at just over 1d. per unit, and 130,000 had been used for street lighting, but nothing had been charged for that. The station charges had come down to ·66d. per unit. They had a total gross profit of £5,100—gross profit represented the difference between revenue and the amount they had to pay for interest and sinking fund, and they had a sum available for dividend, if they had been a company, of £14,977, which represented a dividend of 9 per cent. on the capital invested. That figure was, of course, before paying interest and sinking fund. The present capacity of the generating station was 3,300 KW., the increase being principally due to the demand for motors. The profits made last year and the previous year had been used to pay off the debt on the new machinery which they placed in their station some years ago. The Corporation had received application from firms outside the boundary for an electric supply. In two instances they were firms on the opposite side of the boundary roads, but the Corporation were unable to supply them, and therefore they asked Parliament to grant them an extension of area. The generating station of the Leicestershire and Warwickshire Co. was some 12 miles from Coventry, and it was in a very dilapidated condition. There was nothing in the Bill of the Corporation which prevented the company from supplying power to manufacturers if they could induce them to take it up.

Cross-examined by Mr. HUTCHINSON, Mr. JECKELL said that it was true that the Corporation had no depreciation fund at present, but they were starting one. Between 1896 and 1903 there was a deficit of £11,000 on the undertaking. Up to last December energy equal to 1,000 H.P. had been applied for, and from that date 3,000 H.P.

The CHAIRMAN: I understand that if you had been a company you could have paid for the last three years 6·47, 8·33, and 9·06 per cent. dividends.—Yes.

You admit that there has been a deficit of £11,000 never made good.—That is so.

Mr. VESEY KNOX explained that the £11,000 represented the difference between the earnings, and the interest to be paid and the sinking fund. A company would, of course, have no sinking fund to pay, they would have gone without dividends.

Evidence having been given by manufacturers in the district who were anxious to have the energy supplied to them,

Mr. HUTCHINSON addressed the Committee on behalf of the Leicestershire and Warwickshire Co. He submitted that the Bill was an attempt to encourage the Corporation in a spendthrift undertaking in regard to a commodity which they already could not supply in sufficient quantities to meet the demand in their own boundary, but yet they proposed to supply an area outside the city. The Corporation had already incurred an expenditure of £27,000, and they proposed to borrow another £20,000, and then they were told that £180,000 would be required to meet the possibilities of the next five years, and their engineers had told them that something like £225,000 would be required, so that in all the Corporation would need some £400,000, and surely that was a very large commitment for a Corporation. His company were willing to supply the current for ⅞d. per unit, and the Corporation wanted to charge 1¼d. Should not they consider that? It had been suggested that they were doing nothing to put in force their powers authorised in 1902. They had put down a generating station, and it had been said that no machinery was in it, but did they ever hear of anyone equipping a generating station with machinery before they knew what the demand was? It was only municipalities that dared to rush in where angels feared to tread, and the reason of the company's apparent delay in exercising its powers was that they had been endeavouring to find out the demand, and he contended that it was not expedient to grant the powers to the Corporation.

Mr. C. VESEY BROWN, M.Inst.C.E., M.I.E.E., said he was engineer to the company. He thought the company were right in not equipping the station, as the machinery might, in time, become obsolete. They were willing to supply any firm for ⅞d.

Cross-examined by Mr. VESEY KNOX, WITNESS said they would charge ⅞d. if a consumer would take a minimum supply for 15 years, and coal was not more than 7s. 6d. per ton. To lay a main to the boundary of Coventry from the company's generating station, would cost £2,500 a mile, or roughly £25,000 for a double 1,000-H.P. main. The company had obtained no actual orders for supply, but were in negotiation for several, and he thought contracts would be sealed eventually. The capital of the company was £1,000,000, made up of £750,000 in shares and £250,000 in borrowing powers.

Mr. A. ROBERT HOLLAND, a director, having given evidence, Mr. VESEY KNOX replied on behalf of the Corporation, and maintained that it would be a pity if the traders had to wait until the company could equip their station and set up a plant before they could get a supply.

The Committee found the preamble of the Bill proved.

London and North-Western Railway Bill.

ON Monday Sir W. M'Iver's Select Committee of the House of Commons considered the Bill promoted by the London and North-Western Railway Co., the chief object of which is to confer powers on the company to construct a railway from London to Watford, to be worked by electric traction. The only opponents appearing by counsel against this portion of the Bill were the London County Council and the National Telephone Co.

Sir RALPH LITTLER, K.C., who, with Mr. Hutchinson, appeared for the promoters, referred in his opening statement to the enormous growth of traffic in the neighbourhood of London generally. With regard to the London and North-Western Railway, they had four lines at present out of Euston, two of which were used for express traffic, and two for station-to-station traffic, and both sets of lines were full with traffic. The company had acquired a good deal of land alongside their existing railway between Watford and London in anticipation of future extensions, and they had come to the conclusion that it was not desirable to add to the existing number of platforms at Euston, and that the best method of dealing with the traffic would be to have a railway absolutely independent of the present goods and passenger traffic between Watford and Euston. They proposed to do that by carrying alongside of the existing railway two new sets of lines till they got near Euston, when the new lines would dive into the earth, and tubes would carry them under Euston Station. The tube would be one of the largest used. It would not be the largest, because experience on the Great Northern and City Railway had shown that a tube big enough to hold an ordinary railway carriage used on steam railways was too expensive, but the tube would be 13 ft. 6 in. in diameter. The line would commence at Watford Junction and come through Watford High Street, where a station would be right in the centre of the town. A branch would run from Croxley Green to Watford High Street; then the line would run along the side of the present line and afford accommodation to all the present stations till London Road was reached. Then they dived down into a tube, and when they got outside Euston, between Chalk Farm and Euston, the up-line would pass to the east of Euston Station and the down line to the west, so that they would have a continuous line running from Watford without any shunting or terminal accommodation. They were going to spend £2,366,500 on the scheme, and while they expected the undertaking to be remunerative, it would, of course, be some time before it was so, and it was certainly a case of public advantage. The only opponents appearing by counsel were the London County Council and the National Telephone Co., and the former body were chiefly concerned in the question of workmen's trains. The position of the company in that matter was that they simply left themselves to the general law.

The CHAIRMAN asked whether, except on the instruction of the House itself, the Committee would have any jurisdiction in that matter. He did not deny their competence to insert a clause, but it was usual to leave it to the proper tribunal.

Mr. ERSKINE POLLOCK, K.C., on behalf of the L.C.C., said it would be recollected that there was a report from a Joint Committee, and every Committee had inserted workmen's trains clauses wherever there had been a tube railway Bill before them. They had invariably discussed the matter and inserted a clause.

The CHAIRMAN: The general attitude is to leave it to the general law.

Sir R. LITTLER said it was all very well to say that this clause was put in tubes and tramway Bills, but in those cases the promoters took other people's soil and did not pay for it. Tramways took the public road without paying for it, and, therefore, a committee might be fairly asked not to do anything in the case of a railway like this. He called the Committee's attention to the decision in the case of the Great Western Railway Bill in 1900. The question was raised before the Committee considering that Bill, and they said: "We rule we are practically without jurisdiction on this matter, because there is a tribunal for this purpose." That was what he asked the Committee to do in the Bill now before them. No one had complained at what the L. & N.W. Railway had done. They were carrying people 34 miles to Watford and back for 9d., and the County Council were asking them to carry them for 2d.

The CHAIRMAN said they would hear Mr. Pollock argue the question of jurisdiction.

Sir RALPH LITTLER said that with the exception of 200 or 300 yards the whole of the railway was on the company's own property. With regard to the petition of the National Telephone Co., the promoters were prepared to save their existing rights, and that was all they could concede.

COUNSEL for the National Telephone Co. suggested that the matter could be dealt with on clauses instead of on preamble.

Sir R. LITTLER said the whole dispute between them was that the National Telephone Co. had easements which were terminable at three or six months' notice. They interfered with certain of the Telephone Co.'s posts, and would reinstate them in a suitable manner. What the National Telephone Co. were asking for was a perpetual easement, which they had not got at present. Seeing that the company would soon die, he did not know what they wanted this for, except for compensation from the Postmaster-General.

Mr. LOUIS TRENCH, assistant engineer, was called, and gave evidence. He described the route, and said there were no engineering difficulties. The curves and the gradients were easy between Euston and Watford. The tube portion of the line would cost £185,000, and the other portion £1,209,000, and the widening of the Ricksmansworth branch would cost £142,600. The total length of the line would be 22½ miles. The generating station would be built outside the County of London, in the neighbourhood of Sudbury and Wembley. Ten per cent. of the line only was in the County of London.

Mr. POLLOCK addressed the Committee on the question of workmen's trains, and pointed out that on the eastern side of London the railways ran workmen's trains, and the result was an unequal overcrowding of workmen in certain parts of London. Lord Windsor's Committee, in 1901, reported on the want of uniformity amongst railway companies.

Sir R. LITTLER: But those were tube railways.

Mr. POLLOCK said undoubtedly Lord Windsor's Committee did consider tube railways, but the principle had been applied to a railway very similar to the one before them. The North-East London Railway started in tube till it got outside London, and then ran in the open.

The CHAIRMAN: That was a new railway.

Mr. POLLOCK said the scheme before them was also a new railway. It was to be an electrical line, and would come down to the lower level under Euston Station. This very question was fought in the case of the North-East London Railway Bill, and Mr. Ashton's Committee decided that a clause should be inserted. Something had been said about a 2d. fare, but the County Council did not ask for 2d. They took the Central London Railway clause, because it was a model clause.

As the result of lengthy discussion, followed by consultation, the CHAIRMAN submitted the following clause:—"Proper facilities shall be provided for the carriage of workmen to and from their work over the railway at fares which shall not exceed the fares at present charged for workmen in respect of corresponding journeys over the company's existing line between Watford and Euston. This shall not in any way operate for the prejudice of the Cheap Trains Act"

Sir R LITTLER said the company were perfectly willing to accept a clause carrying out the spirit of the one sketched out.

The Committee then passed the preamble of the Bill dealing with the electric railway, and went on to consider other matters affecting the undertaking generally.

Richmond (Surrey) Electricity Supply Bill.—In the House of Lords on May 2nd this Bill was read a second time.

North-East London Railway.—In the Commons on April 29th this Bill was read a third time.

TRADE STATISTICS OF NEW SOUTH WALES.

THE recently issued trade statistics of New South Wales for 1905 give the following details as to the imports of electrical and other materials; the figures for 1904 have been added for purposes of comparison:—

Electrical materials—	1904.	1905.
From other States of Australia	£976	£1,556
„ United Kingdom	59,854	54,834
„ Germany	12,915	16,944
„ France	291	213
„ United States	14,764	16,210
„ Other countries	2,188	465
Total	£90,988	£90,222
Gas and oil engines—		
From other States of Australia	£924	£1,752
„ United Kingdom	26,725	25,364
„ Germany	398	633
„ United States	11,193	15,027
„ Other countries	559	954
Total	£39,799	£43,730
High speed and turbine engines—		
From other States of Australia	—	£60
„ United Kingdom	13,065	7,554
„ United States	303	97
„ Other countries	132	—
Total	£13,500	£7,711
Other engines (not portable or traction)—		
From United Kingdom	£67,928	£19,123
„ Germany	1,703	1,362
„ United States	4,239	83,652
„ Other countries	293	688
Total	£74,163	£134,825
Electrical machinery and apparatus—		
From other States of Australia	£181	£937
„ United Kingdom	40,828	62,155
„ Germany	5,571	13,977
„ Sweden	1,426	5,348
„ United States	93,125	41,820
„ Other countries	2,775	1,181
Total	£143,906	£115,418
Machine tools—		
From other States of Australia	£2,930	£1,081
„ United Kingdom	17,672	19,723
„ Germany	4,962	2,289
„ United States	17,756	26,787
„ Other countries	566	338
Total	£43,886	£50,218
Rails and accessories—		
From other States of Australia	£700	£433
„ United Kingdom	75,566	32,338
„ United States	13,932	16,930
„ Germany	8,688	2,650
„ Other countries	360	800
Total	£99,246	£53,351

AMERICAN NOTIONS ON DEPRECIATION

AN interesting discussion took place a short time ago in the American Street and Interurban Railway Accountants' Association, Columbus, Ohio, upon the subject of depreciation as applicable to electric railways. The opinions expressed were very generally favourable to the principle of providing for depreciation, and Mr. R. N. Wallis, who read the paper upon which the debate arose, put the case with clearness.

He says that accounting recognises three methods of dealing with depreciation, viz:—(1) The creation of a fund to provide for decrease in value beyond ordinary maintenance. (2) To include betterment charges as expenses, and so keep the values in correct proportion. (3) To ignore the possibility of a deterioration which ordinary maintenance expense does not cover.

Mr. Wallis hit the nail on the head when he referred to the peculiar opinion that while depreciation was right in principle, the longer its consideration could be postponed the better.

The President (W. B. Brockway) in opening the proceedings, remarked that "The companies seem to have gone upon the principle that so long as they deferred the question of 'depreciation' just so long could they pay 10 per cent. in dividends, instead of, perhaps, 3 or 5 per cent. instead of nothing at all."

The discussion arising out of the paper was focused on the question: "Does the maintenance of an electric railway at a high standard of efficiency eliminate the necessity of a charge for depreciation?"

Mr. John I. Beggs, of the Milwaukee Electric Railway and Light Co. and United Railways of St. Louis, supplemented the President's remark by referring to the natural indisposition of financiers and managers to make any provision for depreciation which would prevent a good showing of earnings to be made, at least in the first few years, and asserted significantly that: "Many persons were in the electric railway business, not with the intention of keeping the properties as permanent investments, but for the purpose of making a good showing from operation and then unloading."

Mr. A. H. Ford, an accountant, also asserted that financiers would not discuss the question of depreciation, because in making a reserve fund for the purpose, it might interfere with dividends.

So much for the practical working of the question of depreciation. Then as to recommendations, we find variable opinions advanced. Thus, Mr. F. R. Henry (United Railways of St. Louis) said that in his opinion "the depreciation charge should be set up monthly and based on a percentage of the gross earnings, as thereby each month and year would be charged with the proportion of this reserve, which it could best stand."

Mr. C. L. S. Tingley (American Railways Co.) considered it imperative "that small companies provide month by month, and year by year for taking care of the contingency of renewal, when it should arrive."

Mr. H. I. Davies (Cleveland Electric Railway) pointed out the very unsatisfactory financial position of interurban companies due to the failure to provide for renewal of the property as it wore out, the managers and directors having in view the effect of their reports upon the stock market, rather than the preservation of their properties. He recommended a depreciation reserves account for wear and tear of track equipment, in addition to the ordinary repair charges. He considered that the rule should provide for expenditure for repairs, as distinguished from renewals, and in addition, each month, by way of reserve, a sum large enough to cover wear of the month, this sum to be such a proportion or percentage of the cost of renewal as the month bears to the probable life

of the property, so that when any part of the track or equipment is entirely worn out, and replacement must be made, a reserve sufficient to pay for it will appear on the books.

According to the rule of the Street Railway Accountants' Association in America, the cost of renewals should be charged to expense in the year or month in which the renewals are made. We are not aware of any similar rule in England—but in practice, both in the United States and here—the question of provision for depreciation and renewal is left by the auditors for the directors and shareholders to determine.

We find another word used in America for what we term antiquation or obsolescence—viz., *supersessional depreciation*, or the necessity of superseding unexhausted machinery by new and improved types; and it is not deemed correct accountancy to renew the plant by the investment of new capital. This principle is in accordance with the policy of our own Local Government Board.

The result of the discussion was the adoption of the following resolution, viz.:—"That the maintenance of an electric railway at a high standard of efficiency does not eliminate the necessity of a charge for depreciation unless the word 'maintenance' is construed to cover a sufficient charge set aside for future replacements of depreciated property."

In Mr. Wallis's paper he refers to an effort to arrive at some sort of standardisation of wear and tear, and mentions the effort made by the International Tramways Union in 1904 to tabulate figures for this and a renewal fund.

The opinions of 41 companies were obtained, practically all of them providing for depreciation by annual payments out of revenue, and all but two of them advocating a renewals fund; 12 companies provided for this fund certain percentages of the cost of installation; others adopted a percentage upon capital invested, and took the gross receipts as a basis, while a better method was suggested by Mr. James Dalrymple in a report to the Municipal Tramways Association of Great Britain in 1902, who recommended depreciation credits to asset accounts, aggregating 18 per cent. of the gross expense or 13 per cent. of the gross receipts worked out in the following table:—

	Per car-mile (in pence).	Percentage of cost value.
Permanent way	—	—
Electrical equipment of line	·30	4
Ground	—	—
Buildings and fixtures	·17	3
Power station and sub-station plant ...	·35	6
Workshop, tools and sundry plant ...	·035	2
Cars	·23	8
Electrical equipment of cars	·23	8
Miscellaneous equipment	·02	3
Office furniture	·008	16

It is, of course, obvious that any such suggestions are only approximate, as there are so many contingencies affecting different lines, so that it really comes to what we referred to in a recent article, viz., the necessity for frequent valuations in each case, and this was the opinion of one of the speakers in the discussion, who thought that "the depreciation charge should be set up monthly, but, in any case, a revaluation for every annual account would appear to be necessary."

LEGAL.

ROBERTS *v.* RELIANCE LIFT AND ENGINEERING CO., LTD.

AT Bradford County Court, on Saturday last, plaintiff, trading as Roberts Bros., electrical engineers, sued defendants, claiming for the balance of the price of goods supplied and work done in connection with two electrical lifts at the Bradford Workhouse Infirmary. The full claim amounted to £56 10s., but £38 was admitted. There was, however, a counterclaim of £73 According to the *Yorkshire Daily Observer*, in the summer of 1905 the defendants contracted to supply a service or luggage lift and a passenger lift at the Workhouse, and the plaintiff contracted to do certain work in connection with the construction of the lifts. When the service lift had been erected, it was found not to work satisfactorily, and a London expert was brought down to find out what was wrong. One of the defects which were discovered was in connection with the wiring done by the plaintiff, but counsel stated that that had been caused by the defendants' workmen in doing the mechanical work. One wire, he believed, was not properly connected, but that was a most trivial matter. The passenger lift also did not work properly, and the plaintiff was instructed to do certain work to get the lift into order, and it was in respect of those items that the dispute had arisen. For the defence, it was stated that the plaintiff's workmanship was bad, and the basis of the counterclaim was that his clients were put to serious expense in providing motors of much greater power than those contracted for.

Several witnesses having been called, his Honour reserved judgment.

NATIONAL ELECTRIC SUPPLY CO, LTD. *v.* TATTERSALL.

AT the Preston County Court last week plaintiffs claimed against J. W. Tattersall, licensed victualler, for money due for meter rent, wiring, &c, for an electric light installation, and the defence set up was that the agreement between the company and the defendant was misleading. The defendant said he had been given to understand that the wiring would be supplied free on his agreeing to take current. He believed that on three months' notice he could cease taking current, and be no longer liable for the meter rent or wiring. Judgment was giving for the plaintiff company, with costs, and the judge remarked that the bringing of the case into Court, in face of the agreement, was a mere waste of money.

DEMERARA ELECTRIC CO., LTD., *v.* WHITE AND OTHERS.

THE *Times* of 4th inst. contains a report of the hearing of this appeal by the Judicial Committee of the Privy Council last week. It was an appeal from a judgment of the Supreme Court of British Guiana of March 31st, 1905. The Supreme Court awarded an injunction restraining the appellants from using their machinery and engines so as to occasion a nuisance by noise and vibration to the respondents, or any of them, or the owners or occupiers of their houses, and the appellants were ordered to pay $100 to each of the respondents by way of damages. As regarded the existence of the nuisance complained of and its serious character, their Lordships agreed with the Judges of the Supreme Court. They advised his Majesty that the appeal should be dismissed, but that such dismissal should be without prejudice to any application which the appellants might be advised to make to the Supreme Court for the suspension of the injunction awarded by that Court.

WORKMEN'S COMPENSATION CLAIM.

A CLAIM against the United Electric Car Co., Preston, under the Workmen's Compensation Act, by Thos. Gregson, woodcutter, of Wigan, for the loss of some fingers, has been compounded for £150 by the company.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The State and the Inventor.

There is an unfortunate omission in your rather unfriendly criticism of the suggested reforms of the present Patent Acts (which formed the basis of my Glasgow lecture on "The State and the Inventor"), that is, the omission of the date when the lecture was given, February 16th of the present year.

The President of the Board of Trade, in his speech on the Second Reading of the proposed Amendment Act, foreshadowed the more urgent and important reforms suggested in the lecture. I received the thanks of Mr. Lloyd George for the copy of the report of my lecture before the date of the Second Reading. Whether my suggestions were acted upon, or whether they merely confirmed the desirability of the reforms, does not matter—the reforms are to be adopted, that is *everything*, as far as the inventor is concerned.

The statement in your note that the valid life period depends upon the character (interpreted in my lecture by the extent of the time and cost involved in its commercial perfecting and development) is *simply untrue* of the law as it stands. The life limit is 14 years (subject to the payment of the iniquitous renewal taxes), whether the commercial development of the patent costs £20 or £20,000, and whether the time involved in commercially perfecting the invention is 10 months or 10 years.

I am glad you emphasise the (just) necessity that greater patent life prolongation should be granted, and that the Privy Council adjudication should be displaced by one in a less expensive Court.

It is quite true that the American Patent Department frequently requires the splitting-up of a patent into a process, and into the machinery involved in its application, to secure a clear definition of the subject matter of patent, but the tax proportions are still very heavily in favour of the American applicant. No doubt, as your note remarks, the suggestion as to the Advisory Court is revolutionary, but after all the proposal is only on the lines of the *in forma pauperis* principle of the Divorce Courts, mercifully conceived for poor applicants. Probably in nine cases out of ten the poor inventor is deserving of greater consideration from the State than is the

in forma pauperis applicant for divorce. None of the suggestions contained in my lecture are impracticable; they may, perhaps, be inopportune. The keen interest evinced by the President of the Board of Trade, for which inventors are grateful, should tend to initiate a new policy in the Board of Trade in its relations to the Patent Department, which in both Berlin and Washington is not considered inferior to any other department of the Government machinery in its importance to the welfare of the State. The following, amongst other inventors of world-wide distinction, wrote me that they were in general sympathy with the main reforms suggested in my lecture:—Lord Kelvin, Sir Joseph Swan, the Hon. Charles Parsons, Signor Marconi, Sir Seale Haslam. My friend Sir Oliver Lodge expresses himself as "very much dissatisfied with the (British) Patent Law; it is well adapted," he writes, "to reward trivial inventions in an exaggerated manner, but important discoveries it tends in some ways to burden and discourage."

B. H. Thwaite.

London, S.W., *May 4th*, 1907.

[Being unaware of the fact that Mr. Thwaite had sent a copy of his lecture to the President of the Board of Trade, we, perhaps, did not give Mr. Thwaite so much credit as he deserves for what is excellent in that measure. We do not understand why Mr. Thwaite should characterise as *simply untrue*, our statement that the life period of a patent, under the present law, depends on its character. Only about 6 per cent. of patents applied for survive to the end of the full period of 14 years. The life period of the remainder is, consequently, less than 14 years, and the length of that life period depends on the commercial value or character of the patent. In some cases the full profit that an inventor can expect from his invention is made within the first four years, and in this case the inventor gets a cheap patent (for £4, a cost which is less than in U.S.A.), for a short life period. Patents for articles which have a short vogue, such, for example, as toys, are kept on for the full 17 years in U.S.A., and serve only to obstruct invention, while under our system of renewal fees, they cost less and expire when their day is over.—Eds. E.R.]

Braking Operations for Tramcars.

I am pleased to observe, from your remarks on my letter in your current issue, that we appear to agree on the question that, if regenerative control is going to make the headway desired, the cars now in use must be re-motored. And, in my opinion, it will be a thoroughly good procedure for all concerned, particularly for the managers in hilly districts.

With regard to the letter by "Security" in your current issue, it is, to my mind, one of those guarded contributions, of general indefiniteness, from which nothing or anything may be inferred, excepting, of course, the impression that I am taking a narrow-minded view, and that my claims for regenerative control are extravagant.

Now I am not disposed to consider the question of braking operations for tramcars from a narrow standpoint. It is far too serious a question for circumscribed ideas, but if "Security" can produce a brake as efficient, under all conditions, as that provided by regenerative control, I am open to consider it.

He refers to "the factor of safety on hilly routes being small under ordinary working conditions" . . . . "and the time arrives when the apparatus fails or the operation is not carried out in the quite the proper" manner, or it is . . . . "so complicated that it requires careful thought and action, which in nine cases out of ten it doos not receive." Precisely; that is what regenerative control will eliminate, I hope, and *increase the factor of safety*.

What brakes have been in use when accidents have occurred? Wheel brakes, track brakes, emergency brakes, electro-magnetic brakes, rheostatic brakes—that, I think, fairly exhausts the selection. But I have seen enough brakes on a tramcar to fairly stagger any driver in cases of emergency.

It is to remove those causes of failure, and to give the driver a braking system that requires no thought in cases of emergency, but which he instinctively applies, that I recommend the general adoption of the braking system provided by regenerative control.

"Security" asks what is the result when such a brake fails? I would point out that while other brakes fail, through causes which have been revealed by various accidents—I have no need to enumerate them—the probabilities of the regenerative system failing are much more remote, for the simple reason that, if the equipment is not in working order, through carelessness on the part of the car-shed staff, the driver cannot take his car out of the shed, but he can do so with all other forms of braking apparatus in use, whatever their nature.

Again, I will point out, and I want "Security" to note this, that no accident has occurred through the motors failing at the crisis, where cars have been equipped with rheostatic and electro-magnetic brakes, and a very large proportion of cars are fitted with the latter and none without the former. That is the point worth considering, and where the regenerative motor scores and is superior to other braking methods, but which he absolutely fails to grasp, I fear.

Put all other forms of brake in the background and use a system which operates through the only part of the car equipment which has never yet been found faulty after accident; and, the regenerative system using the motors for service and emergency braking without the complication of unnecessary apparatus, provides, to my mind, the ideal control for a car.

With such advantages as I have endeavoured to advance on behalf of regenerative control, I do not deem it necessary for myself or anyone else to indulge in extravagant statements regarding its superiority for general traction purposes.

If "Security" has any better braking method, I and many others would like to become acquainted with it.

John I. Hall.

Kingston-on-Thames, *May 6th*, 1907.

Of Dogmatism in Science.

Will you allow me to correct a careless blunder in my letter of last week? For the sentence, "If μ and κ be defined as the ratios, respectively, of the permeability and sp. ind. cap. of the medium to those in air (which was their original definition)," &c., read: "If μ and κ, the permeability and sp. ind. cap., be defined as the ratios, respectively, of the induction and displacement at any point in the medium to those in air for the same magnetic and electric forces (which was" &c.) . . . My only excuse for the slip is that the letter was written in haste, and very late at night.

W. M. M.

May 6th, 1907.

Income-Tax and Depreciation.

The query which appears in your "Correspondence" column over the signature of "Secretary," as to the proper amount to allow for depreciation on electrical generating plants, mains, consumers' meters, &c., in making up the income-tax returns of an electrical undertaking, appears opportunely in the same issue as that in which you are good enough to report the paper upon "Depreciation," which I read before the Institution of Electrical Engineers on the 25th ult.

The subject being one upon which I have so recently set out my opinions, I am emboldened to answer the query contained in "Secretary's" letter, and to state that up to the present time no definite schedule of allowances for depreciation for taxation purposes has been agreed by the various assessors throughout the country.

For instance, in every rating case in which I have acted on behalf of an undertaking, I have found the most divergent views existing on the part of the Rating Authorities.

With regard to the amounts which it is proper to allow, I need hardly say that I pin my faith to the figures which result from the estimated years of "life" of the plant, &c., set out in my paper, which appear on page 745 of your current issue, the life of static transformers being corrected from 15 years to 25 years.

It must, however, be borne in mind that in arriving at the allowances for depreciation for rating purposes the sinking

fund basis is not adopted, the deduction being the amount actually representing the average depreciation for one year of the plant, &c.

Thus in respect of plant with a capital value of £10,000 and a life of 25 years, it is necessary to deduct £400 (*i.e.*, 4 per cent.) and not £274 (*i.e.*, 2·74 per cent.) which would be the sum necessary to invest annually at 3 per cent. to replace the value of the worn out plant.

Applying this principle to the "years of life" postulated by me, "Secretary" should claim an allowance of the following percentages :—

Plant, &c.	Years of life.	Percentage of annual depreciation.
Land and buildings	60	1·66 per cent.
Boilers	20	5 ,,
Pumps and pipework	25	4 ,,
Conveyors	10	10 ,,
Engines	25	4 ,,
Turbines	20	5 ,,
Dynamos and alternators	25	4 ,,
Motors	20	5 ,,
Tools and sundries	10	10 ,,
Accumulators	15	6·66 ,,
Transformers, static	25	4 ,,
Converters, rotary	20	5 ,,
Switching apparatus and instruments	20	5 ,,
Meters	10	10 ,,
Mains—Armoured	25	4 ,,
Solid system	30	3·33 ,,
Duct system	30	3·33 ,,

Robert Hammond.

London, S.W., *May 7th*, 1907.

Cheap Water-Power.

The following letter is a copy of one I sent to both the engineer and chairman of one of the three principal railway companies in the kingdom :—

"I beg to call your attention to the fact that, within a four-mile radius of R, there is 2,000 H.P. water running to waste day and night the year through—this being a fair average. In the winter there is two to four times this amount ; in the driest season 1,000 H.P. can be relied upon. Now, if this water-power were harnessed and used for working your system by electric traction between M and H, and at the same time taken full advantage of for lighting purposes—stations and signals—working on the supposition that 4 lb. of coal is required to obtain 1 H.P. per hour, this would save 30,000 tons of coal per annum, calculating only 50 weeks to the year ; and at 10s. per ton for coal, this would mean a saving of £15,000. This power can be harnessed with capital at 5 per cent. not to exceed £1 per horse-power per annum. The cost of power at Niagara is four guineas per horse-power per year, so this is unquestionably about the cheapest power in the world. The very great advantage of water-power is that when the maximum demand for lighting exists, there is a maximum supply obtainable. I am perfectly aware that this communication—as to both the amount of power running to waste and the exceptionally low cost of obtaining same (on the very borders of a teeming population) will not be credited, nevertheless the fact still remains and cannot be disproved. If there has been any erring at all on my part as regards amount of power and the cheap rate obtainable, I have no hesitation in saying that the £1 per H.P. will not only cover interest on outlay, but probably also rent and working expenses. I think it is a great pity that this amount of power in such a centre should be neglected."

Remarkable to say, I have not even had an acknowledgment from either of the gentlemen, which clearly proves a lack of progress and conservatism in such matters which is truly astounding, considering the advantages and possibilities. The possibilities are as follows :—

Aluminium can be produced here at 9d. to a 1s. per lb. ; selling price 1s. 10d. per lb.
Calcium carbide can be produced here at ¾d. per lb. ; selling price 3d. per lb.
Ferro-silicon can be produced here at ¾d. per lb. ; selling price about 3d. per lb.
Portland cement can be produced here at 12s. to 15s. per ton ; selling price 35s. to 40s. per ton.
Ice can be produced here at 1d. per cwt. (working expenses) ; selling price 1s. per cwt.

In the midst of, or at the very door of, this water-power, there are two Urban Councils, population 7,000 to 8,000 each ; one buys its gas at 2s. 6d. per 1,000 cb. ft., the other makes and sells to residents at 3s. 10d. per 1,000 cb. ft. Neither of these Councils has any lighting order. Within a 4-mile radius of this water-power there is a population of over 200,000 ; within a 10-mile radius there is a population of over 2,000,000 ; besides which the district is tapped by three railway companies, and a canal runs right through the centre in direct touch with sea-going vessels. The above enormous advantages, coupled with the enhanced price of coal, make it astounding that such water-power should be neglected and now running to waste.

W. Antrobus,
Hydraulic and Electrical Engineer.

Longsight, *May 6th*, 1907.

BUSINESS NOTES.

South African Trade.—An article on "International Trade Competition in South Africa" appears in the current issue of the *British and South African Export Gazette*. The facts therein set forth are taken from the official returns of the South African Statistical Bureau, and they point to a position which cannot be regarded with anything but alarm by those who wish well to British Trade. Briefly stated, the position is this :—In 1898, the last completed year before the war broke out—which was one of South Africa's best trading years prior to that event, although the high-water mark of prosperty was reached in 1903 with £53,562,312—the total volume of imports into South Africa from all sources amounted to £23,905,516, of which the British share was 69·4 per cent. In 1906 the total of imports was £29,859,672, or £5,954,156 in excess of the value of the imports eight years previously. The British share had then dropped to only 56·8 per cent. Moreover, this rapid decline is still going on, for in February last only 42·6 per cent. of the imports into Natal, and 51·8 per cent. of those into the Cape Colony, were in respect of manufactures or produce of the United Kingdom. On the other hand, the aggregate share of competing foreign countries has increased from 19·5 per cent. to 21·8 per cent., and the one to benefit most has been Germany. Her exports to South Africa continue to rise by leaps and bounds, as witness the fact that in 1890 the United Kingdom enjoyed a percental share of no less than 82·5 per cent. of the entire trade, whilst that of Germany was a beggarly 1·4 per cent. Ever since, our percental share of the trade has continuously declined, until to-day it is proportionally 25·7 per cent. less than it was then. Contrariwise, Germany has leaped from 1·4 per cent. to 7·6 per cent., and last year her trade was actually £1,103,685 in excess of what it was in 1898, whilst that of Great Britain only recorded an increase of £435,641. Shortly put, the trade of the United Kingdom with South Africa is practically at a standstill, and, after all its sacrifices, the Mother Country is only a miserable half-million better in its shipments to the sub-Continent than was the case before the war, whilst collectively the trade of competing foreign countries has jumped from 19·5 to 21·8 per cent.

Electric Air-heater Motor.—Mr. T. E. Weaver, of 83, Newbridge Street, Wolverhampton, has devised an arrangement consisting of a D.C. motor driving a fan and an eddy-current brake (called an "induction heater device"), which, he claims, at the same time heats the air and distributes it. The heater consists of a metallic sheathing round the armature, revolving with the latter in the air-gap, through which the air is drawn by the fan.

Irish International Exhibition.—In the hall in the Palace of Mechanical Arts, at the Dublin Exhibition, which was opened by the Lord Lieutenant on Saturday, May 4th, amongst the electrical exhibitors are W. T. Henley's Telegraph Works Co., Ltd., and the Robertson Electric Lamp Works, who have a display of electric lamps in various stages of manufacture.

THE BRITISH WESTINGHOUSE CO. are exhibiting electric generators of 300 and 400 KW. capacity, driven by Combe-Barbour engines. The former machine will be used for incandescent lighting and power purposes at the Exhibition, and the latter for illuminating the dome and main buildings. The illuminations are arranged in red and white lights, and special Westinghouse change-over gear is in use for switching the full load of the generator from one set of lights to another. Miscellaneous apparatus, including small motors, Cooper-Hewitt lamps, Westinghouse carbon-filament incandescent lamps, Osmin metallic-filament lamps, high-tension oil-break switches, with automatic over-load attachments, ammeters, &c., are also shown on a stand belonging to Messrs. William Coates & Son, Dublin, who are agents for the smaller apparatus of the British Westinghouse Electric and Manufacturing Co. We shall deal with the electrical features of the exhibition at length in a later issue.

Roumania.—The Roumanian Customs authorities have recently given a decision to the effect that "ammeters and voltmeters" are to be classified under article 749 of the Tariff, the duty being 100 lei per 100 kg. On the other hand, energy meters are dutiable at 1·50 lei per kg. under article 764.

Catalogues and Lists.—Edison & Swan United Electric Light Co., Ltd., London, E.C.—Several new leaflets describing, illustrating and pricing their special iron-clad switches, fancy glass shades and time-switches (Venner's patent).

Messrs. Johnson & Phillips, Ltd., Charlton.—New list (HW) 28 pp. well arranged and finely illustrated on art paper, giving full particulars with tabulated prices of hot-wire ammeters and voltmeters of switchboard and portable types; also electrostatic voltmeters.

Messrs. A. P. Lundberg & Sons, Liverpool Road, London, N.—Advance proof of a four-page circular, showing a number of white-on-black diagrams of useful adaptations of their different types of Tumbler switches for electrolier lighting.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—Several new publications. No. 40 (28 pages) is a collection of tables relating to Association electric light cables and wires, vulcanised, of 300, 600, and 2,500-megohm grades. Prices are brought out in red. Fittings, wires, flexible cords are also detailed. No. 40A is a 14-page special price list of concentric and high-tension cables and flexible conductors and cords. Circular giving a brief list of their manufactures, and a view of the Silvertown works; also a small 16 pp. pamphlet containing some tables concerning their cables for electric light wiring.

British Insulated and Helsby Cables, Ltd., Prescot.—Circular No. P40 containing illustrated notes on their Prescot trolley wire (circular, grooved, fig. 8, and special sections); with a table of gauges, diameters, weights, resistances and breaking strains. Also circular No. P41 showing Prescot gun-metal ears for trolley wires, including soldering ears with tinned grooves for circular wire and mechanical ears for circular, grooved and fig. 8 wire.

Messrs. Mather & Platt, Ltd., Salford Ironworks, Manchester.—New catalogue (fourth edition) of multipolar dynamos. It is a 12-page publication in their standard style, well illustrated with half-tones and dimensioned line drawings as usual. Machines for 110, 220, 440 and 550 volts are particularised in tabular form.

Messrs. Kuhl & Vogt, 5, Chester Road, Tue Brook, Liverpool.—Leaflet relating to their "Universal" waste oil filter.

The London Electric Wire Co., Ltd.—Trade list relating to and giving prices of their flexible cords, also flexible cables for dynamo and motor connections. A separate leaflet states the trade discounts for same.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—New general telephone catalogue illustrating, briefly describing, and giving clear figuring as to prices of various patterns of telephone instruments for domestic, commercial and general purposes. The "Regent" telephones are a new type using "transceivers" instead of fixed transmitters; in the Standard pattern telephones many improvements are embodied. There are also listed their "Parsons-Sloper" secret telephones which have been adopted by the G.P.O. for all intercommunication in the Government offices throughout the country. The "Regent" telephones have also been adopted by the G.P.O. The catalogue further describes other instruments, such as mining telephones and instruments specially adapted for asylum use. We understand that samples of all these instruments are to be seen at Messrs. Gent's London office, 3A, Upper Thames Street, E.C.

Messrs. G. Straus & Co., Ltd., 211, Upper Thames Street, E.C.—New edition of their catalogue and price list of electric light accessories, &c., including various electric light wires, cables, flame arc lamps, fans, incandescent lamps, lamp-holders, ceiling roses, wall plugs, ball fittings, switches, insulators, glass shades, and so on. The catalogue (39 pp.) is fully illustrated, and prices are plainly stated. Copies of this publication will be sent to members of the trade on application.

Messrs. Veritys Ltd., London and Manchester, &c.—Two catalogues giving particulars of their electric fans. List No. 525 deals with the "Typhoon" table fans. This is the third year these fans have been before the public; their special feature is that they may be tilted or swivelled in any direction, so that the fan becomes a desk, wall, or ceiling fan at the will of the user. This year the "Typhoon" fans are being fitted with the "CA" brush-holders as approved by the Admiralty. Catalogue 528 deals with the "Aston" ventilating fans from 12 in. to 60 in. These fans are now all fitted with Hoffmann ball thrusts and grease lubrication, rendering any fan equally suitable for horizontal or vertical air discharge. Some recent installations which have been fitted with these fans include the Birmingham University (60 fans), the South-Eastern Hospital (40 fans), Duke St. Hospital, Glasgow (25 fans), Hull School Boards (over 100 fans). The "Aston" fans run at comparatively low speeds, a fact which renders them silent in running. Both lists are illustrated, and tabulated sizes, speeds, prices, &c., are given.

The D.P. Battery Co., Ltd., Lumford Mills, Bakewell.—Revised price list of cells (in ebonite boxes with covers) for electric carriages. We understand that there has recently been a heavy demand for these cells.

The General Electric Co., Ltd., London, E.C.—Leaflets E 1,175 and E 1,176, relating to the "Angold" continuous current arc lamps of the new miniature shuntless type, single and double enclosure, which they have just placed on the market. Prices are stated. This company has decided that in future, instead of issuing "progress" sheets monthly, as has been the case in the past, these will be published once every quarter, viz., February, May, August, November. The publication will be considerably enlarged, and will contain new features, which are explained on the first page of the first quarterly issue (May) which has just been published. In this first number a full illustrated description is given of the "Witton" controllers. A list of the various publications now in issue for the different departments is followed by illustrations, prices and brief particulars of many lines, switch and cut-out boards, wall plugs, cut-outs, gas and water-tight bells, bell pushes in china and fancy brass, direct working and central battery telephone systems, the "Phone-eze" telephone bracket, "Record's" cost indicator for electricity consumers, and so on. We should say that in their new form these G.E.C. publications will be more acceptable than the old "progress" sheets.

Book Notices.—*Notes on Material, Construction and Design of Land Boilers.* By E. G. Hiller, B.Sc., M.Inst.C.E. Manchester: James Collins & Kingston. 1907.—This is the second edition of this work, which represents the practice of the National Boiler and General Insurance Co., Ltd., of which Mr. Hiller is the chief engineer. Many important alterations have been made, and the whole of the notes have been revised. The illustrations are very clear, and rules are given relating to the construction of all ordinary types of boilers in great detail. Riveted joints are very fully treated, new tables and diagrams occupying eight pages having been added. As a guide to boiler-makers and users, the book should be of great value.

The Engineers' Year-Book of Formulæ, Rules, &c. By H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. 1907. Price 8s.—This is the fourteenth year of publication of the well-known Year-Book, which needs no recommendation to those who are familiar with it; but for the information of those who have not yet made its acquaintance, we may say that there are few matters with which an engineer has to deal in his avocation, upon which he cannot gain useful information from its pages. The work is annually revised and enlarged; it now contains 994 pages, including a comprehensive index. To review its contents in detail is a task from which we shrink; those who use it, as the reviewer does, only need to know that the new edition is available. *Verbum sat sapienti.*

Journal of the Institution of Electrical Engineers. Vol. 38, No. 182. April, 1907. London: E. & F. N. Spon. 5s.—Principal contents of this number: "New Incandescent Lamps," by J. Swinburne, F.R.S.; "Light Standards and the High-Voltage Glow Lamp," by C. C. Paterson; "Tests on Carbon, Nernst and Tantalum Lamps," by Messrs. Haworth, Matthewman and Otley; "Regenerative Control of Tramcars," by A. Raworth; "Heating Coefficient of Magnet Coils," by G. A. Lister; and "Rotary Converters *v.* Motor-Generators," by M. Walker.

The Central, April, 1907; Vol. IV, No. 11. London: The C.T.C. Old Students' Association. Price 1s. 6d.—This number contains articles on "The Construction of a New Railway," by A. C. Cookson; "Electrical Test-Shop Measurements," by Percy Good; "Alternating and Direct-Current Traction Systems," by Lionel Calisch; and several other subjects.

The Workmen's Compensation Act, 1906: *Handy Notes for Employers.* By A. F. O. Walbrook, solicitor.—This is a 16-page pamphlet which is being issued by the Law Car and General Insurance Corporation, Ltd., of 4, St. Paul's Churchyard, E.C. It is explained that the object of the notes is to help to bring home to employers a knowledge of the very wide range of the legal liability which has now been placed upon them by Parliament. The sections relate to such matters as (1) persons entitled to compensation; (2) accidents which carry compensation; (3) compensation for injuries due to industrial diseases; (4) notice of accident or disablement and claim; (5) provisions as to seamen and ships' officers; (6) amount of compensation payable; (7) sub-contracting, and so on. Employers in the electrical trades will do well to ascertain shortly the exact position in which they are placed, now that they are soon to bear the burden of this new piece of oppressive legislation.

Our Danish contemporary, *Den tekniske Forenings Tidsskrift* (the Technical Society's Review), which has hitherto been a monthly one, in conjunction with another journal is now published 26 times yearly, viz., every other Wednesday. The Review will appear in a different cover and be entitled *Teknisk Tidsskrift* ("Technical Review"). Prof. William Rung is the editor.

"Practical Mathematics." (Lectures delivered to Working Men.) By Prof. J. Perry, D.Sc., F.R.S. London: Wyman & Sons. 1907. Price 9d.

"Machine Design." By C. H. Benjamin. London: A. Constable and Co., Ltd. 1907. 8s. net.

"Fire Tests with Floors." (Reinforced Concrete, Herbst "Armocrete" tubular system.) Report of the British Fire Prevention Committee, No. 119. London: British Fire Prevention Committee. 1907. 2s. 6d.

"Wireless Telegraphy for Amateurs." By R. P. Howgrave-Graham. London: Percival Marshall. 1907. 2s. net.

"Flying Machines, Past, Present and Future." A. W. Marshall and H. Greenly. London: Percival Marshall. 1907. 1s. net.

"Science Abstracts." Sections A and B. April, 1907; Vol. X, Part 4. London: E. & F. N. Spon. 1s. 6d. each.

"A Handbook of Wireless Telegraphy." By J. Erskine-Murray, D.Sc. London: Crosby, Lockwood & Son. 1907. 10s. 6d. net.

"Die Forging, and the Construction of Dies." By J. G. Horner, A.M.I.M.E. Reprinted from *Engineering*. London: Offices of *Engineering*. 1907. 14s. net.

"The Construction of Dynamos." By T. Sewell, A.M.I.E.E. London: Crosby Lockwood & Son. 1907. 7s. 6d. net.

"Modern American Lathe Practice." By O. E. Perrigo, M.E. London: Crosby Lockwood & Son. 1907. 12s. net.

Messrs. John Wiley & Sons have sent us a list of books published during 1906, which includes several works on steam locomotives, turbines, and steam practice generally.

Dissolutions and Liquidations.—H. S. Wood & Co., electrical engineers, 3, Clarence Street, Manchester.—Messrs. H. S. Wood, J. N. Scott, and C. Brown have dissolved partnership. Messrs. Scott & Brown will continue the business under the old style, and attend to debts.

British Rheostat Co., electrical engineers and manufacturers, 185, Deritend, Birmingham.—Messrs. C. Clements and G. A. Yarwood have dissolved partnership. Mr. Clements will attend to debts and continue the business.

British Electric Equipment Co., Ltd.—First meetings of creditors and contributories are to be held at 33, Carey Street, W.C., on May 14th.

W. R. Sykes Interlocking Signal Co., Ltd.—For the purposes of construction, this company is winding up voluntarily, with Messrs. W. Ives and R. Sykes, 26, Voltaire Road, Clapham, as liquidators. The new company will have the same name as the old.

Otto Electrical Manufacuring Co., Ltd.—A meeting is to be held at 48, Swan Street, Manchester, to hear an account of the winding up from the liquidator.

Messrs. J. A. Haywood & F. A. Woolley, electrical engineers, 14, New Street, Birmingham, have dissolved partnership. Particulars of debts, &c., to A. J. Cale, solicitor, 14, New Street, Birmingham.

Trade Announcements.—The Electric and Ordnance Accessories Co., Ltd., have recently completed arrangements with the British Telephone Supply Co., 17, Bloomsbury Street, Birmingham, whereby they have now full control of all telephone sales. The E. and O. Co. continue to manufacture the "Stellite" instruments, and their agents, who have specialised in all phases of telephone work for many years, have recently made extensive additions to their stocking facilities with a view of making prompt deliveries. All correspondence with regard to telephones should, in future, be addressed to the agents.

Messrs. Bruce Peebles & Co., Ltd., announce that they have found it necessary to improve their office accommodation in the Newcastle district, and that on and after May 1st, 1907, the address of their Newcastle office will be changed to Pilgrim House, Pilgrim Street, the telegraphic and telephonic addresses remaining the same, viz., "Peebles, Newcastle-on-Tyne," and "2620 Central." The transfer will occasion no interruption to the conduct of business, and the office will be, as before, under the management of Mr. F. B. Sinclair.

A trade correspondent learns unofficially that Messrs. Galloways, boiler-makers, Gorton, Manchester, are about to erect big works at Latchford, Warrington.

Exhibitions.—On Saturday, May 11th, the International Laundry Exhibition, organised by the Society of Laundry Engineers and Allied Trades and the Launderers' Association, will open at the Agricultural Hall, and will continue throughout the following week. There will be a large collection of machinery in motion.

At the Chemist's Exhibition, which closes to-day at the Royal Horticultural Hall, Vincent Square, Westminster, Chinnery's multi-coloured sign for electrical and gas illumination is shown by Chinnery's Advertising Signs, Ltd.

Bankruptcy Proceedings.—Francis Williams, electrician, 17, Orchard Road, Bemerton, Salisbury.—Receiving order made April 30th on debtor's own petition. First meeting of creditors, May 16th; public examination, May 23rd—both at Salisbury.

K. C. Moran, electrical engineer and contractor, Walsall.—First meeting, May 17th, at Wolverhampton; public examination, May 30th, at Walsall.

LIGHTING and POWER NOTES.

Brighton.—Considerable trouble has been experienced at the Southwick generating station of the T.C. during the past week or two, owing, in the first instance, to the subsidence of a lock, through which coal is usually shipped, and, secondly, to a washout in an embankment lying between the adjacent canal and the sea, which seriously reduced the condensing water available at the power station.

Bury.—The Electricity Department of the Corporation reports a net profit for the past year of £2,948.

Conway.—The T.C. has decided to apply to the B. of T. for an extension of the E.L. Order, 1905, and to ask the North Wales Power Co. to meet a committee and discuss terms for a supply of electricity.

Continental Notes. — Switzerland. — The *Feuille Fédérale Suisse*, of April 17th, contains a copy of a law enacting the following provisions respecting concessions of water-power in Switzerland:—"The utilisation of water-power is to be supervised by the Federal Government, which will enact laws regarding the granting and holding of concessions, as well as the transmission and distribution of electric power, the provisions necessary for safeguarding public interests and ensuring the rational utilisation of water-power. Allowing for the insertion in concessions of clauses in conformity with Federal legislation, the Cantonal Governments may grant concessions, and fix and levy the dues payable for the use of water-power. The taxes must not be of such a nature as to render the utilisation of water-power too onerous. When a question arises as to the utilisation of power obtained from sections of water common to several Cantons or on the frontier of the country, the Federal Government is empowered, after considering the representations of the Cantons interested, to grant the concession and to fix the dues payable to the Cantons. The derivation of water-power from abroad shall not be allowed without the authority of the Federal Government. Allowing for exceptions that may be provided for by Federal legislation, the provisions of this law shall be applicable to existing water-power concessions.

Framwellgate Moor (Co. Durham).—At a ratepayers' meeting on May 1st, a scheme for lighting the workmen's houses in the district by electricity was adopted. Under the scheme energy will be supplied by the Electricity Co., at 1s. per fortnight for three 16-c.p. lamps, larger consumers to be supplied on a basis of 3½d. per unit.

Goole.—The U.D.C. has decided to invite competitive schemes for the supply of electricity to its area. The B. of T. has refused to extend the Council's E.L. order obtained in 1901.

India.—The Government of Mysore has sanctioned proposals for lighting the streets in Mysore City with electricity.

Lees.—The U.D.C. has made overtures to the Oldham T.C. for the handing over to it of the Electric Light Order obtained some time ago. The matter will be discussed at a conference of the two authorities.

Littleborough.—The U.D.C. has decided to extend the plant at the electricity works at a cost of £4,000.

London.—Hackney.—The E.L. Committee has approved of the addition of three superheaters to the refuse destructor boilers, at an estimated cost of £510.

Stepney.—In view of the fact that the Osborn Street generating station is incapable of any great extension, the E.L. Committee has decided to proceed with a new generating station at Blyth's Wharf, on the river. The scheme provides for four marine type boilers, one 2,000-kw. turbo-alternator, and two 1,000-kw. d.c. turbo-generators—a proportion of which will be erected at Osborn Street in the first instance.

The estimate for a station to deal with the local load at Christmas, 1908, is £36,900, made up of:—Buildings, £6,500; generating plant, £11,650; boilers, &c., £5,750; river work, £6,000; coal and ash plant, £2,000; converting machinery, £5,000.

During 1909 the following additional expenditure must be incurred to enable the Blyth's Wharf station to supply Osborn Street in bulk:—Buildings, £3,000; generating plant, £3,000; boilers, &c., £3,450; coal handling plant, £500; converting machinery, £5,000; extras, £2,000, or a total of £16,950. The estimated cost per kw. generated is £3; per unit, ·25d.; per kw. converted and delivered into L.T. feeders at Osborn Street, £3 12s.; per unit, ·3d. It is proposed that Mr. W. C. P. Tapper, the borough electrical engineer, shall be entrusted with the carrying out of the work.

The electricity accounts for the year ended March 31st last, show a capital expenditure amounting to £265,072; a total income of £36,992; and a surplus after meeting financial and other charges, of £2,125.

Poplar.—The B.C. has agreed to extend the electrical plant at a cost of £5,900. The 12 months' working ending March 31st last shows a 39 per cent. increase in energy sold, the figures being:—Lighting, 929,738; power, 2,423,538; and public lighting, 855,026 units. The net yearly income increased from £25,640 to £30,454.

Wandsworth.—The Wandsworth Gas Co. has written to the B.C. complaining that there is no proper ventilation of the street electric boxes, and suggesting that each box should be filled with some light and easily removable material, and the ends of the ducts carrying the wires into the chamber sealed with plaster or clay. The B.C. has decided to call the attention of the Postmaster-General, the L.C.C. and the County of London Electric Supply Co. to the matter.

St. Pancras.—The E.L. Committee of the B.C. has approved of the erection of a new engine room at the King's Road station to accommodate, in the first instance, a turbine and motor-generator on order, and to facilitate, if necessary, a scheme for concentrating the generating plant at that station. The building is estimated to cost £4,800 and the crane £400.

Considerable trouble has been experienced owing to the burning out of armatures of turbo-generators; recently, owing to this, it was found necessary one evening to feed the positive side of the network from Regent's Park station and the negative side from King's Road station.

Holborn.—The Metropolitan Electric Supply Co. has agreed to reduce its charges for energy to the Council's buildings from 4d. to 3½d. per unit, the Council agreeing to continue to take its whole supply from the company.

L.C.C.—The Parliamentary Committee of the Council decided, on Tuesday last, that the Electric Supply Bill should be submitted for second reading in the House of Commons yesterday, with a view to securing an arrangement under which private enterprise shall undertake the business of the supply of electricity in London under the Council's control. The Parliamentary Committee considers that none of the three private Bills affecting the proposed area of supply now before Parliament constitutes in itself a satisfactory settlement of the question apart from the Council's Bill. By the Bill as drawn, it is pointed out, the Council may either itself carry out the whole of

the undertaking and raise the capital required, or it may assign or transfer its powers to some company or body, leaving the transferee to find the whole or the bulk of the necessary capital and to carry on the business. The Committee thinks that the alternative provisions in the Bill may be utilised for the purpose of securing some arrangement under which the financial risks may be avoided, and the business of the supply of electrical energy carried out by private enterprise under the control of the Council, and holds that the Bill should be proceeded with, with that object in view. The Committee is unable at present to indicate the arrangement into which the Council might eventually enter, but it must be in the direction of providing for a cheap supply of electric power with a sliding-scale of prices and dividends, and a satisfactory purchase clause with regard to the undertaking. This would render desirable the deletion of the clauses relating to the compulsory acquisition of the undertakings of the Metropolitan B.C.'s. As regards the transfer to the Council of the powers of purchase over the company's undertakings which are vested in the Metropolitan B.C.'s, the Committee thinks that these provisions should be distinguished from those relating to compulsory acquisition, and that therefore the Council might consider whether it was not advisable to possess those powers.

Middlesbrough.—In a recent issue we referred to an agreement entered into between the Cleveland and Durham Power Co. and the T.C. for a bulk supply to the latter, and other matters. We gather from a letter in a local paper, that while the present annual output of the municipal works amounts to 1½ million units, the T.C. has agreed to take 1·4 million units per annum from the company. The latter also is apparently empowered to supply direct to the large ironworks, &c., in the town. The writer contends, of course, that the municipal plant, costing £100,000, is likely to be scrapped.

New Zealand.—The *Mining Journal* says that at the New Zealand Crown Mine it is the intention to construct an electrical power plant at the company's mill. The power will be exclusively used for the purpose of pumping. The present steam equipment will be reserved entirely for haulage purposes.

Oldham.—At last week's meeting of the Electricity Committee suggestions were made for a reduction in the charges for energy used for power purposes. It was stated that if the charges could be brought down to a certain level, a syndicate would use electricity to the extent of 1,000 H.P. for driving the machinery of a certain cotton mill. A sub-committee has been appointed to consider the question in all its bearings.

Oulton Broad.—The U.D.C. has received notices from the local electricity company and Lowestoft T.C. of their intention to apply for prov. orders for E.L. The Council is considering the matter *in camera*.

St. Albans.—The B. of T. has sanctioned the transfer of the E.L. order obtained by the R.D.C. to the North Metropolitan Electric Supply Co.

Shipley.—The working of the E.L. department for the past year shows a deficit of £703. It has been agreed to adopt a flat rate of 4½d. per unit for lighting purposes, and to abolish entirely the maximum demand system of charging.

South Africa.—JOHANNESBURG.—The T.C. has decided to invite tenders for an auxiliary steam-driven plant, to consist of two 500-KW. sets, estimated to cost £21,000, including other items in connection therewith. Messrs. Robeson & Behr, of the Consolidated Gold Fields Co., have been consulted, and agree with the general manager in advising high speed, double-acting, enclosed reciprocating engines of the Belliss or similar type. It was suggested that prices be obtained from Messrs. Dick, Kerr and Co., Siemens Bros. & Co., Mather & Platt, and Allen, Sons & Co., it being stipulated that such firms in tendering must show plants of at least 800 KW. running successfully elsewhere. The subject of steam turbines was also gone into, but it was felt that the extra cost in condensing water would make them less economical than the reciprocating type. Regarding the type of boilers, it was recommended to install either Babcock & Wilcox or the Stirling type. It is estimated that the Town Council could then generate at 1·45d. per unit, or 2d., including interest and depreciation, which figures are based on an annual output of 10,000,000 units.

Stockport.—The T.C. on May 1st, decided to apply for a loan of £12,000 for the following purposes:—500-KW. set, and steam and exhaust piping, £3,100; water softening plant, £600; boiler, stoker and superheater, £1,500; coal conveying plant, £1,500; feed pump and piping, £250; motor for induced draught, £100; centrifugal pump and piping for condenser, £200; offices and boiler house roof, £2,500; mains extensions, £2,250.

Walthamstow.—A L.G.B. inquiry was held on April 30th, into the application of the U.D.C. for a loan of £26,580 for electricity purposes. Mr. Spurr, electrical engineer, said that the new steam plant proposed to be installed would be sufficient to provide 100 per cent. more power, based on the present consumption, than would be used during the next two years. The Inspector said he considered the amount asked for was excessive, and he adjourned the inquiry *sine die*. Counsel appeared in opposition on behalf of the Municipal Association.

Wimbledon.—The T.C. has decided to request the L.C.C. to exclude the local area of supply from the L.C.C. Electricity Supply Bill.

Wigan.—A Joint Committee has approved of the erection of a destructor with steam raising plant at the Bradford Place electricity works. Inquiries are to be made as to a suitable type of plant.

York.—The past year's working of the electricity department shows a revenue amounting to £13,706; after deducting working expenses and financial charges there is a deficit of £618. The total deficit to date amounts to £4,908.

TRAMWAY and RAILWAY NOTES.

Bacup.—The T.C. has received from the B. of T. consent to the purchase of the Rossendale Valley tramways.

Belfast.—The T.C., at a meeting on May 1st, finally agreed to purchase the Cavehill and Whitewell tramway for £60,000.

Bury.—During the past year the working of the tramways has resulted in gross receipts of £50,650; the car-miles run were 1,250,000; and the number of passengers carried about 10,000,000. The average receipts per car-mile on the Bury sections were 10·08d., on those of Heywood the same figure, and Radcliffe 7·05d. The net balance, after payment of all charges, was £5,225 Of this £2,500 had been allocated to the reserve fund, and the balance to the relief of the rates. Of the amount in the relief of rates, £1,800 will be required to meet a debit balance on the Radcliffe section—only, however, by way of loan, as that section will, as soon as it begins to realise a profit, require to refund the amount to Bury.

Carnarvon.—A discussion took place at the meeting of the County Council on May 3rd, concerning the Bettws-y-Coed Light Railway. The Committee reported that Mr. Marples (solicitor to the promoters of the route between Bettws-y-Coed and Penmachno and Corwen), Mr. Lloyd Jones (engineer) and Mr Carter (manager of the Penmachno Slate Co.) had attended at the meeting of the Surveyor's Committee in support of the County Council's application for permission to insert in the draft order a clause authorising the Council to advance to the Light Railway Co. a sum not exceeding £4,000, either by way of loan or as part of the share capital of the company, or partly in one way and partly in the other. Mr. Darbyshire, in moving the adoption of the report, explained that if the County Council gave the consent asked for, it would in no way bind it to contribute to the company. After some discussion the report was accepted.

Derby.—The T.C. has agreed to expend £17,800 in extending the tramways in Nottingham Road.

Italian Railways Electrification.—The British Westinghouse Co. is at present engaged in manufacturing two 5,000-KW. three-phase, 15 period, 13,000 volt, 900 R.P.M. turbo-alternator units complete, for the Italian State Railways. These generating sets will be installed in a power station for supplying three-phase current for traction purposes to the Giovi Line, near Genoa. Although, electrically, the sets are not the largest which have been built, on account of the low speed necessitated by the very low frequency, mechanically the machines will be the largest of their kind built. The generators will have laminated fields with low-voltage direct-connected exciters, conforming in this respect to Westinghouse standard turbo-alternator construction. These sets will supply three sub-stations, in which static transformers will step down the pressure to 3,000 volts, for use on the trolley lines. The whole of the main station and sub-station switchgear for dealing with the output will be manufactured by the British Westinghouse Co. The engineer for the scheme is Mr. Kalman un Kando, who was responsible for the electrical design of the equipment now in operation on the Valtellina Line.

Leeds.—The Tramway Committee has agreed to construct a branch line, 1½ mile long, from its Stanningley terminus to Pudsey, taking over the local powers for that purpose, and paying any expense incurred to date.

A deputation of the Guiseley, Yeadon and Rawdon Councils is shortly to wait upon the Leeds Tramway Committee to urge the latter to extend the tramways to Yeadon. It is suggested that the local Councils concerned may agree to contribute towards any deficiency in working such tramways.

Leyton.—The North Metropolitan Tramways Co. has decided to appeal against the award of Mr. Graham Harris in the arbitration connected with the acquisition of the company's mile and a half of tramway line in the borough. The company's valuation was £73,442, but the arbitrator awarded the sum of £19,189. The Council has resolved to take the necessary steps to oppose the appeal.

Liverpool.—As an experiment, the Corporation has placed on the Croxteth Road route a new type of tramcar, with cross seats after the style of the L. & Y. electric trains, and should it prove satisfactory, other vehicles of a similar pattern will be supplied.

London.—L.C.C.—At the Council meeting on Tuesday, Mr. A. F. Buxton submitted the estimates of receipts and expenses for the year 1907-8. In the course of his speech the chairman of the Finance Committee referred to the tramways, which he said were still largely in a state of transition, owing to the reconstruction

proceeding on the northern system. In future, the tramway accounts were to be divided only as between horse traction and electric traction. The really vital financial consideration arising on the tramway estimates appeared to Mr. Buxton to be the probable results of electrical working. The estimates for 1907-8 showed that there would be a surplus on the working of the electrical sections of no less than £557,085 on the basis of traffic receipts at 1s. per car-mile, and working expenses at 7¼d. per car-mile. It was found that the actual traffic receipts for 1906-7 over the whole of the electrical sections averaged 11·94d. per car-mile, while those for 1905-6 were 12·09d. per mile. It was expected in the current year that they would again reach 1s., but even if slightly less, the estimate of the mileage to be run had been taken on a low basis, thus allowing a considerable margin on the total estimate of receipts. In all the calculations the Finance Committee had taken the total revenue, including receipts from advertisements, &c., at 1s. per car-mile. The estimate of working expenses had been taken in such calculations at 7d. per car-mile, including power expenses. The actual expenditure for 1906-7 had not yet been precisely ascertained, but it was expected to work out at about 7½d. per car-mile, while the estimates for 1907-8 showed a figure of 7¼d. per car-mile. Against the estimated surplus of £557,085 on the electrical sections, the speaker pointed out that there must be set an estimated deficiency of £49,640 on the lines still operated by horse traction. The sum of £5,500 was added for interest on balances, &c. There was consequently a balance of £512,945 to meet the interest and sinking fund and other charges amounting to £471,157, leaving an estimated net surplus of £41,788 on the year's working. It was proposed out of that to set aside £35,000 to the renewals reserve fund, being the same amount as was transferred last year, instead of the £62,500 which appeared in the estimates. Including the estimate of this year the amounts set aside under that heading would total £140,000, which represented about ½d. per car-mile instead of 1d., which was the least at which the Council ought to aim. The chairman of the Finance Committee proceeded to remark that they were all agreed as to the desirability of building up an adequate renewal fund. Since the work of reconstruction had been in hand the yearly surplus on the undertaking had not been large, and the practice had been to carry to the renewals reserve fund round sums (£35,000 in each of the last three years) representing practically all the available surplus. The financial results of working an undertaking in which the sum of nearly £7,000,000 had already been invested, and on which a further sum of £5,500,000 was to be expended, were a matter of serious and constant concern to the Council. In conclusion, Mr. Buxton stated that the Finance Committee was considering what steps should be taken in order that the fullest possible light might be thrown on various points connected with the tramways, and of other trading ventures of the Council. After discussion, the estimates were considered by the Council in detail.

Last week the Council voted £15,000 for the electrification of tramways between Beresford Square and Wickham Lane (Woolwich). It was also decided not to consent to an application by the Erith U.D.C. for permission to construct lines at Abbey Wood under its Act of 1903.

Musselburgh.—It has been decided to grant powers to the local tramway company to extend its route to Prestonpans, Cockenzie and Port Seaton; the line is to be constructed to the satisfaction of the B. of T., the company paying for road widenings required by the Board, and paying a proportion of the cost of other widenings.

Preston.—We are indebted to Mr. Jas. F. Simpson, electrical engineer and manager, for the following particulars of the last two years' working of the tramways:—

	1906-7.	1905-6.
Gross revenue	£37,906	£33,178
Working expenses	20,996	19,807
Gross profit	16,950	13,371
Financial charges	11,594	10,607
Net profit	5,357	2,764
Passengers carried	8,459,742	7,234,494
Car-miles run	904,581	789,391

During the past year the revenue amounted to 10·06d., and working expenses to 5·57d. per car-mile; 1,461,307 units were generated, the works cost per unit being ·349d.

Renfrew.—The County Council has decided to oppose, so far as affecting the interests of the county, the provisional order promoted by the Paisley District Tramways Co. for the construction of tramways on portions of the Parkhouse, Pitshell and Thornliebank Roads.

Rochdale.—The B. of T. has sanctioned the borrowing of £35,923 by the T.C. for tramway purposes, £27,681 being for electrical equipment and £8,242 in respect of cars.

Salford.—The annual report of the Corporation Tramways Committee shows that the traffic income for the year ended March 31st was £232,542. This, added to the interest on investments and miscellaneous income, amounting to £4,900, made a total income of £237,442. The working expenses include £45,177 for energy, £46,202 for traffic wages, £11,926 for maintenance of cars, £5,473 for maintenance of permanent way, £3,032 for overhead equipment and other expenses, making a total of £142,193. This left a profit of £95,249, or an increase of £13,431 on the profit of the previous year. The interest and sinking fund charges, amounting to £40,795, rents to other authorities £25,410, and miscellaneous items £1,155, reduce the net profit to £27,889. The Committee has decided to transfer £13,000 to the relief of the rates, and to carry the balance of £14,889 to the depreciation and renewal fund. This fund now amounts to the satisfactory figure of £46,145. During the year the system carried over 43½ million passengers, and travelled 5,268,933 miles.

The B. of T. has appointed Major Cardew to be the referee to determine the price to be paid by the Salford Corporation to the Eccles Corporation for the supply of electrical energy for the tramways within the borough of Eccles.

South Africa.—PIETERMARITZBURG.—The result of the first complete year's working of the tramways is a revenue amounting to £11,490 and working expenses of £11,989, or a deficit of £499, irrespective of financial charges. The receipts amounted to 9·98d. per car-mile, and working expenses to 10·4d. per car-mile; 2,009,655 passengers were carried, and 276,321 car-miles run. The prevailing business depression in the locality is held to account for the poor results.

Spen Valley.—The Yorkshire (Woollen District) Electric Tramways, Ltd., has applied to the B. of T. for an extension of time to May 30th, 1908, for completing the tramways under the Spen Valley Light Railways Order, 1901.

Stockport.—The T.C. has applied to the B. of T. for an extension of time until July 10th, 1910, for completing the electric tramways under the 1902 order.

Tramway Authorities and P.O. Proposals.—A conference took place at the General Post Office on the 3rd inst., between Sir Robert Hunter (solicitor), and Major O'Meara (chief engineer), on behalf of the Post Office, and representatives of the Municipal Tramways Conference on the question of the Postmaster-General's proposal to utilise the tramway standards of overhead systems for the support of telegraph and telephone wires. It was agreed that the Post Office would do its utmost to minimise the danger arising from the adoption of such a system, and that the Postmaster-General would accept responsibility for damage done as the result of placing telegraph and telephone wires on tramway standards.

Walsall.—An important alteration has at length been made in the tramway service in this district, the double route from Walsall to Wednesbury and Darlaston having been finished, and a through service with these towns established by arrangement with the B.E.T. Co.

Wimbledon.—The T.C., as a result of renewed application by Sir Clifton Robinson, gave permission to the L.U.T. Co. to open for public traffic the tramways in Worple Road, the Broadway, and Merton Road, on May 2nd last, subject to the B. of T. passing the line, and to the company completing the remaining portion of the route.

TELEGRAPH and TELEPHONE NOTES.

Cables in the North Sea.—The Westerland-Arendal section of the Hoyer-Arendal cable is now jointly owned by the German and Norwegian Governments, whereas the Hoyer-Westerland section is owned by Germany alone.

Telegraphs and Telephones in British India for 1904-5 and 1905-6.—During the above two years the telegraph system of British India has increased by 7,548 kilometres of line and 50,160 kilometres of wire, viz., from 96,044, 341,168 and 470 kilometres of line, wire and cable to 103,592, 391,329 and 1,010 kilometres respectively. Of the cable, 621 kilometres are owned by the Government.

Interruptions dealt with in 1904-5 numbered 50,648, as against 56,982 in 1905-6. The figure for 1903-4 was 43,162, so that there is a considerable yearly increase. During 1905-6 ordinary causes accounted for 511 interruptions, while 485 were caused by cyclones and storm, 101 by floods, 102 by lightning, 42 by fire, 327 by fallen trees, 693 by birds and animals, and 1,489 by unascertained causes. The extraordinary increase for the last year was due to an earthquake in 1905 and exceptional storms and floods.

A system of wireless telegraphy opened in October, 1905, between Diamond Island and Port Blair, works successfully, and 27,000 words a month have been transmitted since the opening.

The number of telegraph offices increased from 6,481 in 1905 to 6,723 in 1906, while the number of employés was 5,962.

The Baudot system between Calcutta and Simla works satisfactorily, and it has been possible to work duplex between these two towns by using a copper wire, the distance being 1,930 kilometres.

The internal traffic numbered 9,354,283 telegrams, and the international traffic 1,106,834 telegrams during 1905-6, making a total traffic of 10,461,116 telegrams, or an increase of 1,362,771 telegrams over the figures for 1904-5, but of this increase 1,214,942 telegrams are claimed by internal traffic, caused chiefly by the visit of the Prince and Princess of Wales, and speculations in grain.

The traffic receipts for 1905-6 were 11,457,995 fr. for the internal service and 3,844,232 fr. for the international service, making a total of 15,302,227 fr., or about £612,089, an increase of about £28,755 over the 1904-5 result. The smallness of the increase is chiefly due to rate reductions between Europe and British India, which came into force on August 1st, 1905.

The total receipts for 1905-6 amounted to 20,308,725 fr., or about £812,349, while the expenses totalled 14,913,414 fr., or about £596,536, and the surplus represents a return of 3·49 per cent. on the capital cost of the system, which, in 1905-6, reached the sum of 154,492,180 fr., or £6,179,687.

Telegraphic Interruptions and Repairs :—

Cables.	Interrupted.	Repaired.
Cayenne-Pinheiro	Aug. 13, 1902 ..	..
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo } Closed..	Jan. 12, 1906 ..	..
Reissa-Issa and Reissa-Yemani (Yemen) ..	Oct. 22, 1902 ..	..
Tarifa-Tangier ..	Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed) ..	Mar. 9, 1904 ..	..
Garachico-Santa Cruz ..	July 12, 1906 ..	..
Las Palmas-Arecife ..	Aug. 18, 1906 ..	..
New Brunswick-Prince Edward Island ..	Jan. 9, 1907 ..	..
Cadiz-Teneriffe ..	April 10, 1907 ..	May 6, 1907
Dakar-Conakry ..	April 24, 1907 ..	..
Gibraltar-Tangier ..	April 25, 1907 ..	..
Landlines.		
Puerto-Barrios ..	Aug. 28, 1902 ..	..

Wireless Telegraphy.—In a recent decision, Judge Townsend, of the U.S. Circuit, Southern District of New York, has denied the motion for a preliminary injunction made by the Marconi Wireless Telegraph Co. of America *v.* The American De Forest Wireless Telegraph Co., on the ground that the latter's use of the liquid barretter and antennæ infringed the Marconi fundamental patent. In denying the injunction, Judge Townsend stated :—

"Furthermore, Prof. Ives, one of the experts for defendants, in support of his claim that defendants' device is a perfect electrical contact, quotes from the opinion of Judge Wheeler in National Electric Signalling Co. *v.* De Forest Wireless Telegraph Co., *supra*, as follows :—

"An immersion of platinum of a diameter of ·00004 of an inch to the depth of ·00002 of an inch is mentioned in the specification, 'for example,' but there is added : 'The immersion of the terminals should be such as to insure what is known in the art as a perfect contact between the terminals and the liquid.' This perfect contact appears to be the operative and material thing, and the defendants' device in question appears to, and must to be of any use, have that.

"In that case, the defendant De Forest Co., which used the detector herein complained of, was enjoined against its use, on the ground that it was a perfect electrical contact, while in this case, an injunction is sought on the ground that said detector is an imperfect electrical contact."

In the suit above referred to, the National Electric Signalling Co. obtained a decision against the De Forest Co., carrying with it costs and damages, and also an injunction. The accounting in this case has now been nearly completed, and we understand that the De Forest Co. will have to pay a large sum to the National Electric Signalling Co. for its infringement of this patent.

CONTRACTORS' COLUMN.

Openings for new Business.

ABERGAVENNY.—Presbyterian Church (£4,200). E. A. Johnson, architect, Abergavenny. J. G. Thomas & Sons, builders, Abergavenny.

ACCRINGTON.—Brush works to be built in Brush Street. Reuben Phillips, owner.

BEDFORD.—Additions and alterations to the Swan Hotel. T. Thurlow, architect, High Wycombe, Bucks.

BASFORD.—Public baths in Vernon Road (£7,500). F. B. Lewis, City architect.

BIRKDALE.—Wesleyan Chapel (£3,000). H. E. Peach, 37, Chapel Street, Southport, architect.

BODMIN.—Catholic Priory. O. Ralling & L. Tonor, Exeter.
Private residence and other works for Mr. A. C. Pomery. W. J. Jenkins, architect, Bodmin.

BOLTON.—Messrs. John Harwood & Son, cotton spinners, are to carry out extensions at their Great Lever Mills.

BRIDGEND.—Extensions to Court Colman (mansion). Cook & Edwards, architects, Masonic Buildings, Bridgend.

COVENTRY.—Conversion of Barr's Hill House into Girls' Secondary School by T.C. (£4,950).

FALKIRK.—Comely Park School—alterations and extensions (£4,478). A. & W. Blacks, architects, Falkirk.

GODALMING.—Municipal buildings and additions to Borough Hall. J. H. Norris, Bridge Street, Godalming, borough surveyor.

GLASGOW.—Hotel alterations, Caledonian Railway Central Station. Chief Engineer, Company, Glasgow.
New leather works. J. Tullis & Son, Ltd., 86, John Street, Bridgeton.

GRAYS (Essex).—Palmer's Endowed Schools to be extended (cost, £14,509).

GUISELEY (Yorkshire).—Engineering works. H. Chippindale, architect, Guiseley.

GREAT YARMOUTH.—New church for St. James' Parish. Olley & Haward, architects, Queen Street, Great Yarmouth.

HEBDEN BRIDGE (Yorkshire).—New spinning mill and weaving shed, to be built at Luddenden Foot. Architects, Sutcliffe & Sutcliffe, Hebden Bridge.

ILFORD.—New hall and vicarage for St. Clement's Parish (£3,000).

LEEDS.—Four factories for the Wall Paper Manufacturers, Ltd. Messrs. Mosley, 6, Wormald Row, Leeds.

LIVERPOOL.—New offices for Royal Liver Co., George's Dock site. W. Aubrey Thomas, architect, Liverpool.

LUTON.—New premises, to be lit by electricity, for the Conservative Club. J. Cumberland & Sons and J. Brown & Sons, architects, Luton.

LONDON (Bermondsey).—Schools in connection with Christ Church. Newman & Newman, 31, Tooley Street, architects and surveyors.
(Bermondsey).—Extension of warehouse. Battley, Sons & Holness, 21, Old Kent Road, builders.
(Bermondsey).—Factory and bakehouses, Jacob Street. W. Nash, Crown Works, Childers Street, Deptford, builder.
(Bermondsey).—Additions and alterations to Infirmary for Guardians. W. Lawrence & Son, Canal Works, Waltham Cross, builders.
(Acton Green).—Extension to factory for the Wilkinson Sword Co., Southfield Road. J. A. Porter, builder, Acton Green.
(Ealing).—Four large houses in residential area, Creffield Road. W. Daley & Co., builders, 8, Twyford Avenue, Acton Hill.
(Marylebone).—Royal National Orthopædic Hospital, Great Portland Street, abutting on Bolsover Street. R. Plumbe & Harvey, 13, Fitzroy Square, W., architects.
(Kensington).—Buildings upon the site of Nos. 183 to 195, Kensington High Street. Chesterton & Sons, 140, Kensington High Street, agents.
(E.C.).—Factory, Fann Street, Aldersgate Street E.C. P. B. Tubbs, 68, Aldersgate Street, architect.
(Westminster).—Buildings for the Westminster Dragoons, Imperial Yeomanry. D. B. Hedderwick, 38, Gt. James Street, Bedford Row, W.C., architect.
(Tooting).—Buildings for Wandsworth Guardians. Cecil A. Sharp, 11, Old Queen Street, Queen Anne's Gate, S.W., architect.
(Highgate).—Workmen's dwellings (£39,690). E. J. Lovegrove, engineer and surveyor, Hornsey Borough Council.
(Highgate).—Laundry for H. A. Lay, 51, Highgate Hill, N.
(Battersea).—Factory for Morgan Crucible Co., Ltd., Church Road.
(Hackney).—Junior Mixed School. Treasure & Son, Cottenham Road, N., builders.

MANCHESTER.—New works to be built in Trafford Park for Taylor Bros., The Forge, Leeds.
New Ward Pavilion (Monsall Hospital). City architect, Town Hall, Manchester.
New Warehouse, George Street and York Street. Contractors, Robert Neill & Sons, Strangeways.
Large extension of the Refuge Assurance Co.'s head offices in Oxford Street. Contractors, Wm. Brown & Son, Salford.
Block of new shops and offices facing Piccadilly. Contractors, Robert Neill & Sons, Strangeways, Manchester.
(Withington).—Receiving Wards at Workhouse for Chorlton Union. C. Clegg & Son, architects, 21, Spring Gardens, Manchester.

MORLEY (Yorks.).—Technical School. W. E. Putnam, architect, Town Hall, Morley.

NEWPORT (Mon.).—Public Market. R. H. Haynes, borough engineer, Town Hall.

OLDHAM (Hollinwood).—New Cotton Spinning Mill, to be called "The Argyle Mill," owned by a new limited company. Secretary, Mr. Harold C. Waterhouse, Hollinwood.

OLD TRAFFORD.—New Parish Church (St. John's) (£4,600). R. B. Preston, architect; G. Macfarlane & Son, builders.

PLYMOUTH.—New Public Schools at Prince Rock (£13,730). Thorneley and Rooke, architects, Plymouth; A. N. Coles, builder, Plymouth.
New Wesleyan Schools and Lecture Hall to be lit by electricity (£2,825). Thorneley & Rooke, architects, Plymouth; Pearn Bros., builders, Gilwell Street, Plymouth.

PONTEFRACT.—Refuse destructor for the T.C. J. E. Pichard, borough surveyor.

PORT GLASGOW.—Boy's Brigade Institute (£1,200). Secretary, Brigade, Port Glasgow.

RADCLIFFE (Lancs.).—Four shops for the U.D.C. W. L. Rothwell, engineer, Council Offices, Radcliffe.

REYDON (Southwold).—New public school. A. Pells, architect, Beccles.

READING.—Lady Wantage Residential Hall for Men (£26,000).

RUNCORN.—New Council schools. J. Lightburn, Education Offices, Town Hall, Runcorn.

SALFORD.—New fire station, with firemen's quarters, Mount Street, Pendleton. Plans in preparation.

SOUTH SHIELDS.—Six pairs of Cottage Homes, Superintendent's House, and Receiving Home for the Board of Guardians. G. R. Smith and H. Chapman, architects, 67, King Street, South Shields.

STALYBRIDGE.—New cotton mill (90,000 spindles). Ray Mills, Ltd., owners.

WAKEFIELD (Silcoates).—Rebuilding North Congregational School. Oliver and Dodgson, architects, Leeds.

WARRINGTON.—New Palace Theatre, Friar's Gate. C. W. Davenport, builder, Stocton Heath.

WEST HEATH (Congleton).—Infectious diseases hospital. A. Price & Son, architects, Sandbach.

WIMBLEDON.—Additions to factory in South Road. Thomson & Pomeray.
Bank. W. H. Gaze & Sons, Kingston Hall Road, Kingston, builders.

WORKSOP.—New public schools (£4,935). T. Fish & Sons, builders, Pilcher Gate, Nottingham.

CONTRACTS OPEN and CLOSED.

OPEN.

Aston Manor.—May 11th. High and low-tension three-phase cables for lighting supply to Erdington U.D. See "Official Notices" April 26th.

Barnes.—May 14th. Steam, exhaust and other piping for the electricity works. See "Official Notices" April 26th.

Bedford.—May 25th. Cables for 12 months. See "Official Notices" to-day.

Belgium.—May 18th. The municipal authorities of Brussels are inviting tenders for the supply and erection at the gas works, of four static transformers, two 60-K.V.A. alternators, 18 synchronised motors, &c. Particulars may be obtained from, and tenders are to be sent to, Le Collège des Bourgmestre et Echevins, Hotel de Ville, Brussels.

Belgium.—May 24th. Tenders are required for the installation of electric light in the Royal Museum of Antiquities and Armoury at the Porte de Hal by May 24th. A deposit of £20 is required. Specification No. 38 at 3d. and plans at 1s. 7d. may be obtained at 15, Rue des Augustins, Brussels. Tenders are to be addressed to the Directions, Générale des Ponts et Chaussées, 38, Rue de Louvain, Brussels.

Belfast.—May 11th. Coal for the Tramways and Electricity Department for one year.

Bristol.—May 20th. A.C. and D.C. flame arc lamps for the Corporation. See "Official Notices" April 26th.

Cambuslang.—May 22nd. 70-KW. motor-generator; A.C. and D.C. switchgear; battery and booster for the electricity works extensions. See "Official Notices" May 3rd.

Colne.—May 13th. 360-KW. D.C. dynamo and Belliss engine; Lancashire boiler with superheater, for the Electrical Committee. See "Official Notices" May 3rd.

Ealing.—June 1st. One water-tube boiler for the electricity works. See "Official Notices" to-day.

France.—May 15th. Tenders required for the construction of the section from the St. Lazare Railway Station to the Place Pigalle of the underground electric railway from the Porte de Versailles to the Place Jules Joffrin. Tenders will be opened on May 15th at 4 p.m. at the offices of the Société du Chemin de Fer Electrique Souterrain Nord-Sud de Paris, 20, rue d'Athènes.

Gravesend.—May 10th. Cables, battery, balancer and booster, and switchboard for the Electricity Committee. See "Official Notices" April 26th.

Knaresborough.—Tenders are being invited for the searchlight and telephones in connection with the carnival on August 15th next. Apply C. Hebblethwaite, Hon. Sec.

Hammersmith.—May 17th. Feeder and distributing mains and house service cable for the B.C. See "Official Notices" to-day.

Hull.—May 23rd. One 500-KW. high-tension continuous-current dynamo and Belliss engine for the electricity department. See "Official Notices" to-day.

L.C.C.—June 11th. High and low-tension switchgear for five tramway sub-stations. See "Official Notices" April 26th.

L.C.C.—May 14th. Electric light and bell installation, &c., for Westminster Technical Institute. See "Official Notices" May 3rd.

Limerick.—June 11th. Stores of the Electricity Department. See "Official Notices" to-day.

London.—May 15th. Engineering stores and supplies and electrical accessories for the Metropolitan Asylums Board. See "Official Notices" to-day.

Manchester.—May 16th. Washed coal slack for the Electricity Committee for one year.

New Zealand.—June 1st. The Wanganui Town Council requires tenders for materials for about six miles of electric tramway track with all plant, machinery, cars and apparatus for working the tramway. Particulars may be obtained from the Town Clerk.

Rochdale.—May 15th. Boiler, pipe-work, &c., for the Electricity Committee. See "Official Notices" to-day.

South Australia.—June 12th. The Postmaster-General requires tenders for 500 Meidinger line cells; 500 Meidinger line cups; 5,000 Meidinger line corks and tubes; 6,000 Meidinger line zincs; 6 tons of sulphate of magnesia; and 7 tons of crushed sal-ammoniac.

Spain.—May 16th. The municipal authorities of Villanueva de Duero (province of Valladolid) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years. Tenders are to be sent to El Secretario del Ayuntamiento de Villanueva de Duero (Valladolid), whence particulars may be obtained.

Spain.—The Spanish Post and Telegraph authorities have just invited tenders for the establishment of a telephone line between Alicante and Elche.

Stretford.—May 10th. Condensing plant and accessories, switchboard instruments, and electrical connections for 500-KW. generator. Mr. T. L. Miller, 19, Brazennose Street, Manchester. (Deposit one guinea.)

St. Pancras.—May 13th. Arc lamp carbons for the Council. See "Official Notices" April 26th.

Warrington.—May 21st. Economiser, tank, water softening plant for the electricity department. See "Official Notices" to-day.

Whitehaven.—May 28th. Condenser, auxiliary plant, piping, etc., for the Electricity Department. See "Official Notices" to-day.

CLOSED.

Accrington.—The T.C. has accepted the tender of Messrs. W. T. Glover & Co., Ltd., for the supply of 3,500 yards of cable, and that of British Insulated and Helsby Cables, Ltd., for three distributor pillars.

Burton-on-Trent.—The Borough Education Committee has accepted the tender of Messrs. Barnett & Soans, of Burton-on-Trent, for installing the electric light at the Pupil Teachers' Centre.

Falkirk.—The Corporation has authorised the purchase of two further "Underfeed" stokers for the electricity works.

France.—The Post and Telegraph authorities in Paris have just placed contracts for a total of 600 tons of copper wire as follows:—La Société Electro-Metallurgique de Dives, 50 tons, 2½ mm. diameter, at 3,580 fr. per ton. La Compagnie Générale d'Electricité, Paris, 100 tons ditto, at 3,590 fr.; and 50 tons, 3 mm. diameter, at 3,560 fr. Les Trefileries du Havre, 50 tons, 2½ mm. diameter, at 3,590 fr.; and 100 tons, 3 mm. diameter, at 3,570 fr.; and 50 tons, 4 mm. diameter, at 3,541 fr. Les Mines et Fonderies de Pontgibaud, 50 tons, 3 mm. diameter, at 3,550 fr. La Compagnie Francaise des Metaux, Paris, 50 tons, 4 mm. diameter, at 3,538 fr.; and 50 tons ditto, at 3,541 fr. M. Grammont, of Pont de Cheruy (Isere), 50 tons ditto, at 3,520 fr.

Glasgow.—The Tramways Committee has accepted the following offers:—

Vulcabeston flanges and washer for controllers.—London & Clark.
Trolley cord.—International Register Co.
Giant strain insulators.—London & Clark.
Axles.—Glasgow Railway Engineering Co.
Tires.—Brown, Bayley's Steel Works, Ltd.
Wheels.—John Baker & Co.; Glasgow Railway Engineering Co.
Chilled iron brake blocks and car wheels.—Miller & Co.
Carbon brushes.—Le Carbone.
Cast-iron castings.—J. & A. Law; R. Howie & Co.; and D. King & Sons.
Malleable iron castings and cast-steel castings.—Springfield Steel Co.
Iron and steel.—P. & W. MacLellan, Ltd.; J. T. Donald & Co.
Springs.—George Turton Platts & Co.; Cockburn, Ltd.
Tie-bars.—P. & R. Fleming & Co.

Halifax.—The T.C. has accepted the tender of the Chloride Electrical Storage Co. for the supply of a regulating booster, at £750, and a switchboard for use with the same, at £150.

Hastings.—Messrs. Venner & Co., of Westminster, have just received an order for 51 "C" type time switches to deal with the street lighting here. This is probably the largest single order for this class of apparatus that has yet been placed in this country.

London.—ST. PANCRAS.—The Electricity Committee has accepted the tender of Messrs. Crompton & Co. for two motors, at £114 each.

FULHAM.—The Electricity Committee has received 16 tenders from firms for the annual supply of nutty slack, and has provisionally accepted the tender of Messrs. J. H. Gilman & Co. for the supply of 2,000 tons of West Hallam nutty slack, at 12s. 3d. per ton delivered alongside the Council's wharf, as required during the year, and with the option of an additional 1,000 tons, at the same price during the same period. The Committee have further accepted the tender of the Underfeed Stoker Co. for two Underfeed stokers, including draught gauges, steam-tight ash-pit doors and a spare motor, for £523 10s.

BERMONDSEY.—The following tenders were received by the B.C. for a voltmeter reading 400-600 volts:—

Crompton & Co., Ltd. .. .. .. (accepted)	£5	13 4*
Kelvin & James White, Ltd.	5	15 0*
Nalder Bros. & Thompson, Ltd.	6	12 0
Elliott Bros.	11	11 2*
British Westinghouse Electric & Manufacturing Co.	17	4 0*

* Less 2½ per cent.

The tender of Cloke's Breeze, Ltd., has been accepted for removing flue dust and clinker from the electricity station, &c., as follows:—Flue dust (estimated quantity 4 to 6 tons per week), 1s. 6½d. per ton; clinker (estimated quantity 130 to 160 tons per week), 1s. 6½d. per ton. A clause is to be inserted in the contract providing that should the Council determine to close the destructor, the contract shall be forthwith terminated.

Portsmouth.—The Borough Education Committee has accepted the tender of Messrs. Thos. Potter & Sons for installing the electric light at the Technical Institute, at £1,199. Eighteen tenders were received.

Salford.—The T.C. has accepted the tender of Messrs. R. Johnson & Co., of Manchester, for the supply of trolley heads and accessories, and that of Messrs. J. Wolstenholme & Son for cast-iron pipes for the turbo-generator.

Wrexham.—The T.C. has accepted the following tenders for supplies to the electricity works for the ensuing year:—

Henry Caldwell & Co.—Engine-room stores.
Siemens Bros.—Cable jointing requirements.
W. H. Keys.—Bitumen and joint-box compound.
Cable Accessories, Ltd.—Service cut-outs.
Sloan Electrical Co.—Arc-lamp carbons.
Davies Bros.—Wood troughing.
Lee, Howl & Co., and the Acme Chemical Co.—Boiler solution.

MODERN POWER PLANT AT THE "ARGYLL MOTORS" WORKS, ALEXANDRIA, GLASGOW.

A very complete power plant has been installed for driving the fine new works of Messrs. Argyll Motors, Ltd., at Alexandria, near Glasgow.

This consists of modern gas engines, utilised partly for direct driving and partly coupled direct to electric generators, which in turn supply a number of B.T.-H. motors distributed through the works for driving machine tools; also the works lighting.

The gas plant was constructed by Messrs. A. Rodger and Co., Govan, and consists of eight producers each capable of supplying gas for 200 B.H.P. Each gas producer unit is complete in itself with safety seal, hydraulic box, cooling pipes, coke and sawdust scrubber, and the plant is so designed that any unit or part may be disconnected and cleaned without interfering with the action of the rest of the plant. Thus, any scrubber may be shut off and cleaned without interfering with the production of gas from the corresponding producer, the gas meanwhile being passed by suitably placed valves through the other scrubbers.

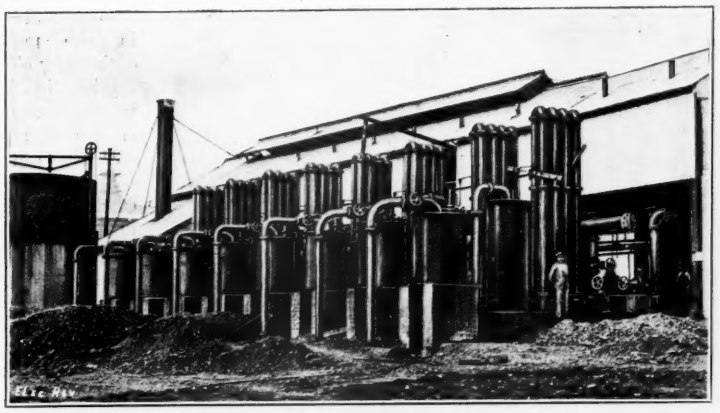


Fig. 1.—Gas Producer Plant, installed at the Works of "Argyll Motors," Ltd.

The pressure of the gas is regulated by a gas-holder, which also controls the supply of air to the producers. This control is obtained by a suitable connection between the stop valve of the engine driving the blowers and the gas-holder: so that when the gas-holder is at its full height, the engine throttle valve is completely closed and consequently no air is supplied.

The air for the producers is supplied by means of two Roots blowers which are belt-driven by the steam-engine already referred to.

The exhaust steam from this engine is conducted to the producers and supplies the hydrogen necessary for enriching the gas.

The railway runs right up to the plant, the trucks emptying into a hopper, from which the coal is conveyed by a bucket elevator and spiral conveyor to the firing platforms of each producer. A good idea of the extent of the producer plant is obtained from fig. 1.

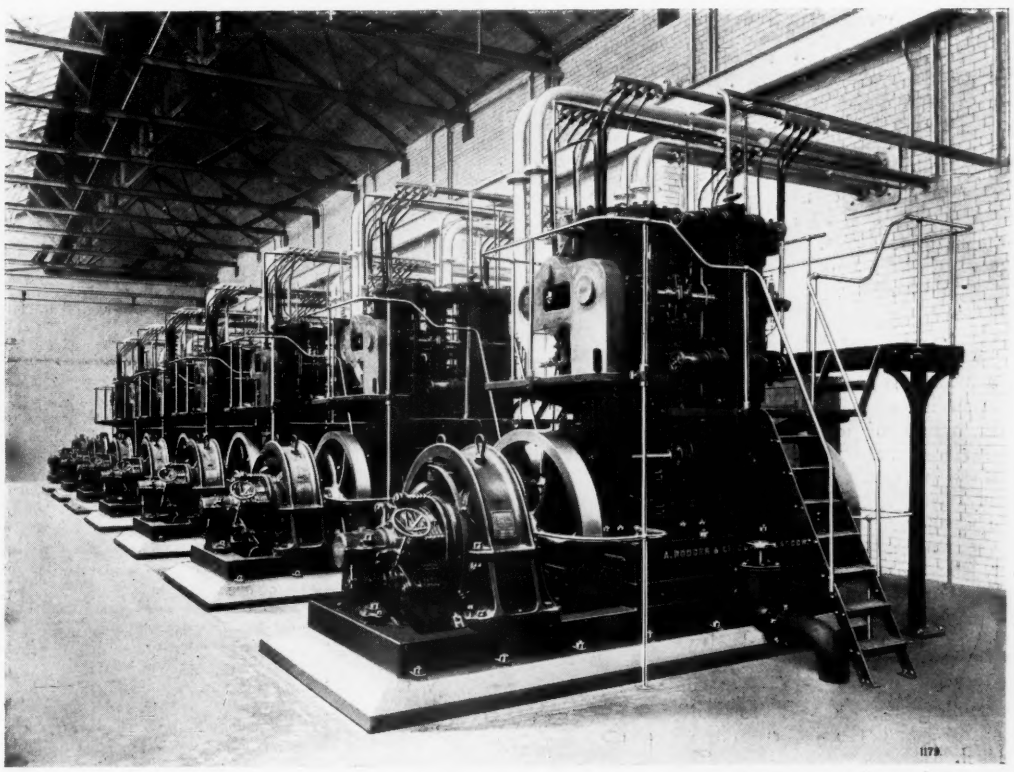


Fig. 2.—View of the Rodger-Rowden-Crompton Generating Plant, Argyll Works.

A 24-in. gas main leads from the producer plant to the engines in the power-house and works, and supplies at present eleven engines, a sufficient margin being left for considerable extension.

F

The engines, which are especially interesting, are of the Rodger-Rowden type, constructed by the previously-mentioned firm under the patents of Prof. W. T. Rowden. They are of the four-cylinder type, with two cylinders in tandem over each crank pin, the cranks being at an angle of 180°.

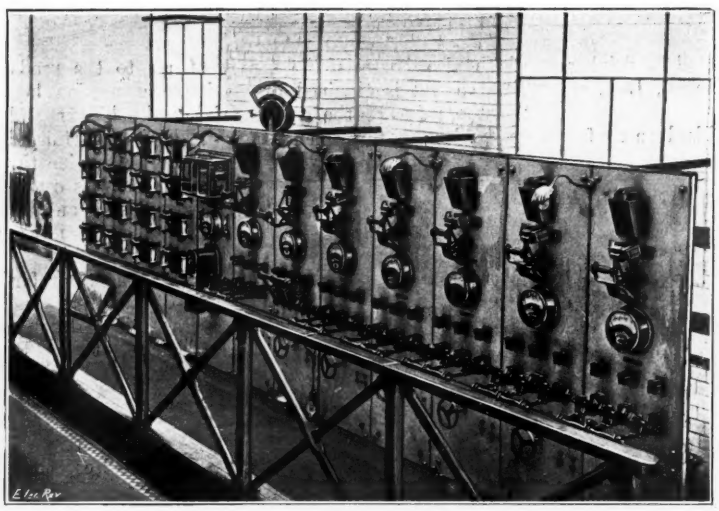


Fig. 3.—The Main Switchboard, Argyll Works Power Plant.

The governing arrangement is such that even at reduced loads the engine is working with maximum economy.

Pressure lubrication is employed, and sight feeds are fitted in the various lubrication pipes.

The engines run at a speed of 280 R.P.M., and by the special arrangement of the cylinders, two impulses are given at each revolution. The cycle of operation is a modification of the Otto cycle, with the addition of a scavenging arrangement, which clears out the products of combustion from each cylinder before a new charge is admitted. This secures a clean cylinder for each charge, and results in great regularity of firing. Views of this type of engine are given in figs. 2 and 4.

At present there are seven sets in the power house (shown in fig. 2); the generators, supplied by Messrs. Crompton, being of the direct-current type; the output of a combined set is 65 KW. at 220 volts pressure. The switchboard, shown in fig. 3, is remarkably simple, and consists of seven generator panels, each containing a single-pole circuit-breaker, ammeter, field regulating rheostat, and plugs for the paralleling voltmeter.

These panels are connected by the bus bars to the recording panel, which contains two meters, one controlling the output to the lighting panel and the other to the power panel.

The paralleling of the various machines is carried out by means of a Kelvin paralleling voltmeter.

Both the lighting and the power mains are led in a duct along one side of the power house, which passes through the wall to an inspection pit, where the cables are drawn into 3-in. diameter tubes, leading to the various departments. As already suggested by the arrangement of the switchboard as regards lighting and power panels, separate mains are run to every department for these two distinct purposes, each department having its own controlling switches.

The machine shop is driven by four independent gas engines, of similar type to those direct coupled to the dynamos in the power house; the power in the other shops in the factory and the supplementary power in the machine shop is supplied entirely by electric motors.

The lighting in the main shops throughout the factory is by means of arc lamps, of the enclosed, open and flame types, numbering in all about 450. Many hundreds of incandescent lamps are, of necessity, installed in the basements and other departments, these all helping to bring up the load on an already overtaxed power house.

For this description and the accompanying views, we are indebted to the courtesy of Messrs. "Argyll Motors," Ltd., a firm whose name sufficiently indicates the nature of its business, and whose up-to-date works merit a more extended reference than is possible in these columns. We are also indebted to Messrs. Crompton for assistance rendered.

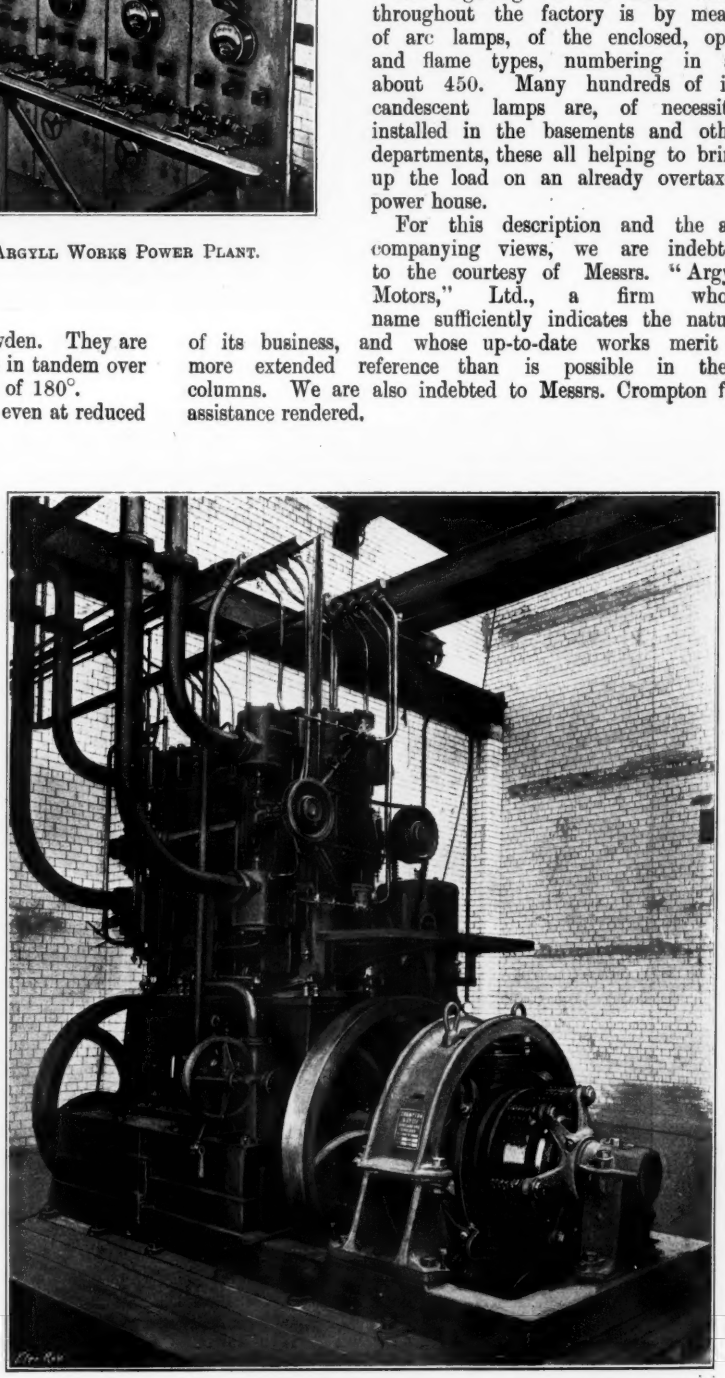


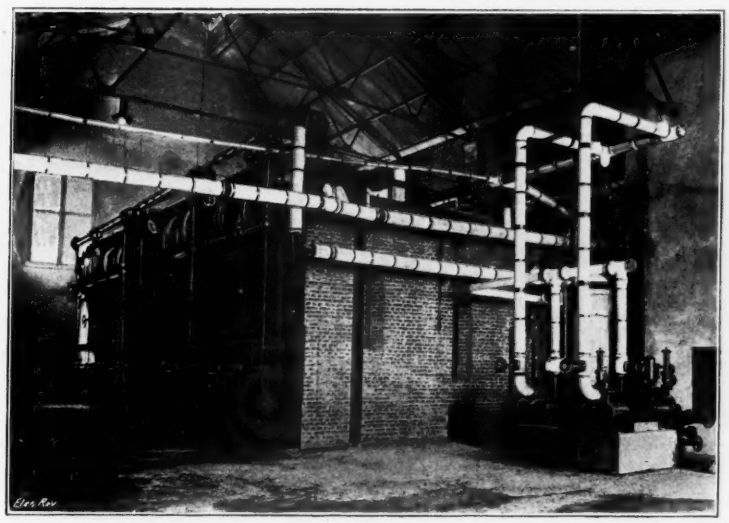
Fig. 4.—A 65-kw. Unit, consisting of a Rodger-Rowden Gas Engine coupled to a Crompton Generator.

ELECTRIC TRAMWAYS IN MONTEVIDEO.

Tramways in Montevideo date from the year 1868, when the first mule tramways were opened; the modern city, however, has a population exceeding 300,000, and some 150 miles of tramway are at present in operation.

In December, 1904, an agreement was made between the United Electric Tramways of Montevideo and Messrs. J. G. White and Co., contractors, for the complete reconstruction of the existing horse tramways to electric traction, and the erection of a power house to supply the required power.

The constructional works were started in March, 1905, and the opening ceremony took place on November 19th last. The electrification of these lines (practically 51 miles single track) and the erection of the power station therefore took some 20 months, which, considering the many attendant difficulties, was exceptionally quick work.



The Boiler House, Montevideo Tramways Power Station.

All the track is laid to a gauge of 4 ft. 8½ in., with 87-lb. rails on the straight and 100-lb. rails on curves. The rails are laid on concrete stringers, the latter having a depth of 6 in., and a width of 15¼ in.

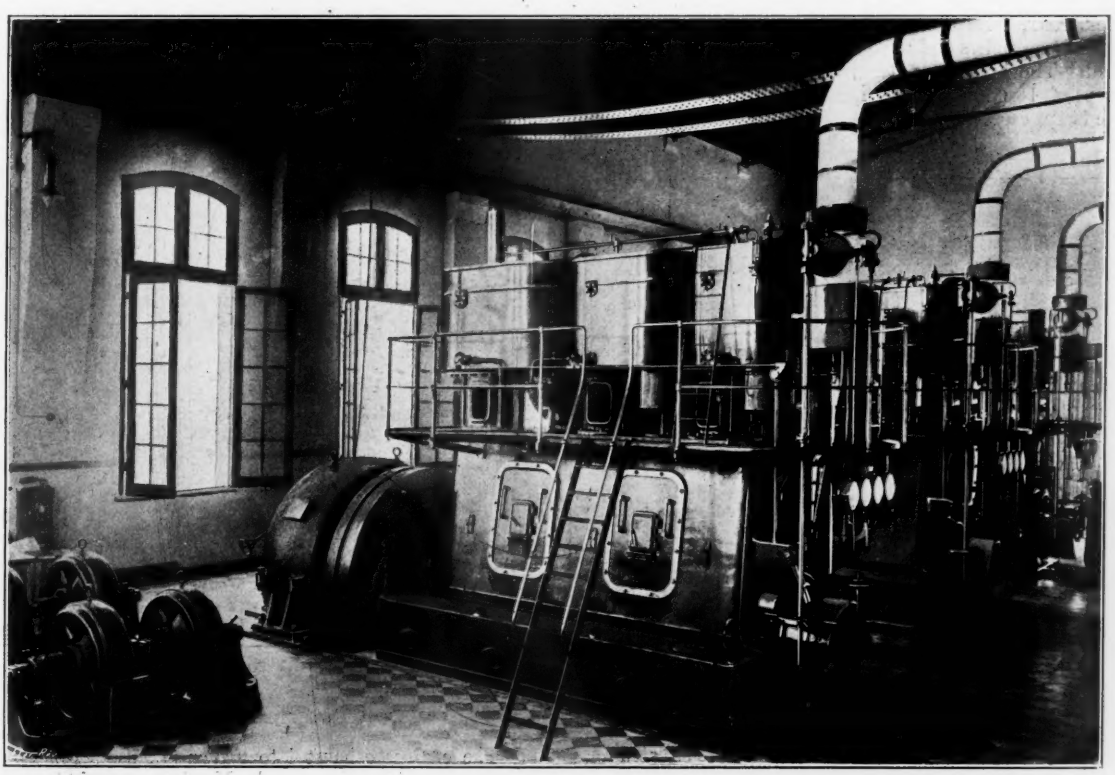
The distance between centres of tracks is 9 ft. 10 in., and the minimum distance of the running rail from the pavement 3¼ ft. All special work for the track, except the points, was manufactured by the Lorain Steel Company and the points were supplied by Messrs. Hadfields.

The overhead equipment is of side pole and steel span wire construction, with both tubular and lattice poles, in three sizes, planted in 6 ft. of concrete. The tubular poles are used only in the Plazas and a few of the main streets.

The trolley wire is of No. 00 B. and S. grooved copper wire, flexibly suspended, with a total length of 70 miles, divided into half-mile sections.

The section insulators are of special make, and were manufactured by the Electric Tramway Equipment Co. They consist of an ordinary double-break section insulator with the addition of a knife switch. The switch is closed by means of a long bamboo pole, which is usually hung on a pole and secured by a padlock. A hook on the end of the pole fits into a hole in the blade of the switch, at the back of which is a spring. This spring, pressing down the blade, assists in making a quick contact. Three car sheds have been provided, the largest having accommodation for 40 cars.

The workshops at these depôts have been fitted up with

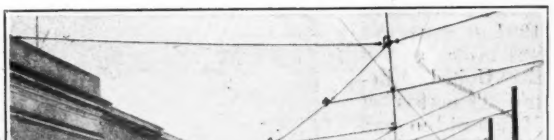


View of the Belliss-Bruce Peebles Tramway Generating Plant, Montevideo.

the most modern tools and appliances, and are well lighted throughout with arc and incandescent lamps. The power for driving the repair shops is supplied by two Lancashire Dynamo and Motor Co.'s motors, one of 15 B.H.P., and the other of 10 B.H.P.

The rolling stock includes 70 double service cars, 20 open cars (all single-deckers) and one flat car, built by the United Electric Car Co. The double service cars are designed so as to be available as open or closed cars according to weather conditions, and will seat 32 passengers.

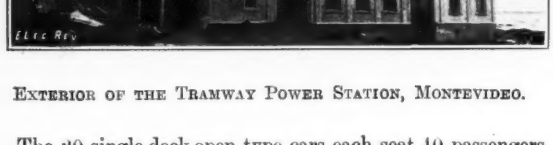
Exterior of the Tramway Power Station, Montevideo.

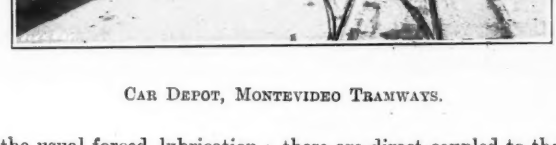


Car Depot, Montevideo Tramways.

The 20 single deck open type cars each seat 40 passengers. The car bodies are mounted on Brill trucks, 6 ft. 6 in. wheel base, with steel-tyred wheels. The trucks also are fitted with life guards of the folding type.

The electrical equipments of the cars, furnished by Messrs. Dick, Kerr, consist of two 36-B.H.P. motors, with series-parallel controllers and a trolley with straight under-running head. The lighting of the cars includes 15 incandescent lamps of 16 C.P. each, the lights being on three circuits of five lamps each.





Street Scenes, Montevideo Tramways.

The power house is a steel frame structure situated close to the water edge.

The steam raising plant comprises four Babcock & Wilcox boilers, each capable of evaporating 11,300 lb. of water per hour, with natural draught and at a working pressure of 180-lb. per sq. in. Each boiler is fitted with an internal superheater capable of superheating 150° F.

A Green economiser, used in connection with these boilers, contains 400 tubes and is fitted with electrically-driven scraper gear.

Two Worthington horizontal steam-driven direct acting feed pumps, each capable of delivering 4,500 gals. of water per hour, are installed for boiler feeding; the feed water is drawn from a hot well at a temperature of 80° F.

A Wheeler feed-water heater, capable of dealing with 3,000 gals. per hour of boiler-feed water at boiler pressure, is installed in connection with the boiler-feed plant, also a Worthington feed-water meter for measuring the feed water.

Installed in the engine-room are three Belliss & Morcom three-crank enclosed triple-expansion engines, fitted with the usual forced lubrication; these are direct-coupled to the generators and have a speed of 250 R.P.M.

The normal full load of each engine is about 1,000 B.H.P., but they are designed for an overload of 25 per cent. and 50 per cent. for short periods.

The guaranteed steam consumptions are:—Full load, 12·2 lb.; three-quarter load, 12·3 lb.; and half load, 13·1 lb.

Repairs in the engine-room are facilitated by a 20-ton hand crane, of Messrs. Higginbottom & Mannock's make.

The engines exhaust into two surface condensing plants, manufactured by Messrs. Cole, Marchent and Morley.

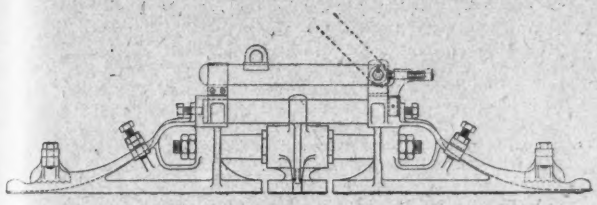
Each of these consists of a counter current surface condenser, a pair of steam-driven Edwards air pumps and an electrically-driven centrifugal circulating pump, and is capable of dealing with 24,400 lb. of exhaust steam per hour; the condensing water being drawn from the sea.

Each of the air-pumps is of the Edwards fly-wheel single-acting type, driven by compound steam cylinders,

mounted over the pump bodies, and is capable of dealing with 17,000 cb. ft. per hour.

Each centrifugal circulating-pump is direct coupled to a 15-B.H.P. motor, and will deliver 72,000 gals. per hour at a speed of 650 R.P.M.

The generators, each of 750-KW. output, at 550 volts,



SPECIAL TYPE OF COMBINED SECTION INSULATOR AND SWITCH, USED ON THE MONTEVIDEO TRAMWAYS.

direct current, are 10-pole machines fitted with compensating poles. They were built by Messrs. Bruce Peebles & Co.

There are also installed in the engine-room two negative booster sets, supplied by the Electric Construction Co.

The first, of 22-KW. capacity, consists of a 550-volt motor coupled to a 315-ampere 70-volt generator; and the second, of 25 KW., consists of a similar motor coupled to a 625-ampere 40-volt generator. The speed in both cases is 1,000 R.P.M., and the combined over-all efficiency at full load, 75 and 76 per cent. in the two cases.

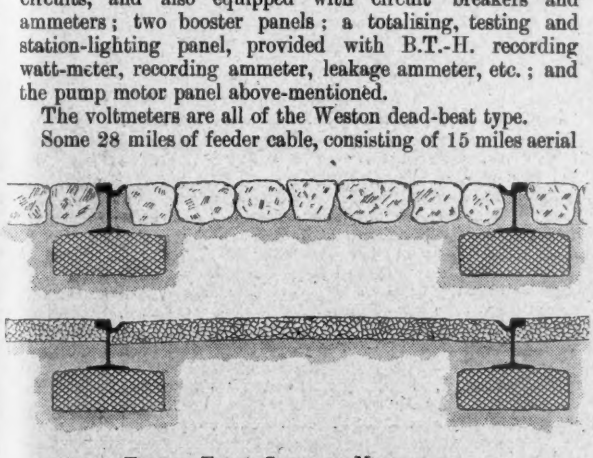
The main switchboard was supplied by the B.T.-H. Co. and is so arranged that there is a clear passage, 4 ft. wide, behind and around it. The arrangement of the instruments and fittings is such that each generator and booster panel is self-contained; but the feeder panels each control two feeders.

The total output and testing instruments and station-lighting circuits are all arranged on one panel; there is also a panel for controlling the centrifugal pump motors.

The board is made up of three 650-KW. generator panels, equipped with circuit breakers, ammeters, field rheostats, etc.; four panels, each arranged for two 300-amp. feeder circuits, and also equipped with circuit breakers and ammeters; two booster panels; a totalising, testing and station-lighting panel, provided with B.T.-H. recording watt-meter, recording ammeter, leakage ammeter, etc.; and the pump motor panel above-mentioned.

The voltmeters are all of the Weston dead-beat type.

Some 28 miles of feeder cable, consisting of 15 miles aerial



TYPICAL TRACK SECTIONS, MONTEVIDEO.

and 13 miles underground, has been installed, also 7,200 yds. of armoured test and telephone cable.

The insulated cables are of the single conductor type, armoured, and laid direct. The aerial cables which are of hard drawn copper, are double braided and treated with preservative compound. The cables were supplied by the Lahmeyer Electrical Co. and Messrs. Johnson & Phillips.

We are indebted to Messrs. J. G. White & Co. for the above particulars.

A New Galvanic Element.—The Austrian papers contain a description of a new galvanic cell invented by Herr J. Köhler, which consists of a carbon cylinder serving as the positive pole, with a cylinder of calcium carbide inside it as the negative pole, the electrolyte being a solution of common salt. The element, however, is said to be somewhat dangerous, as explosions have happened with it on several occasions without any apparent cause.

FORTHCOMING EVENTS.

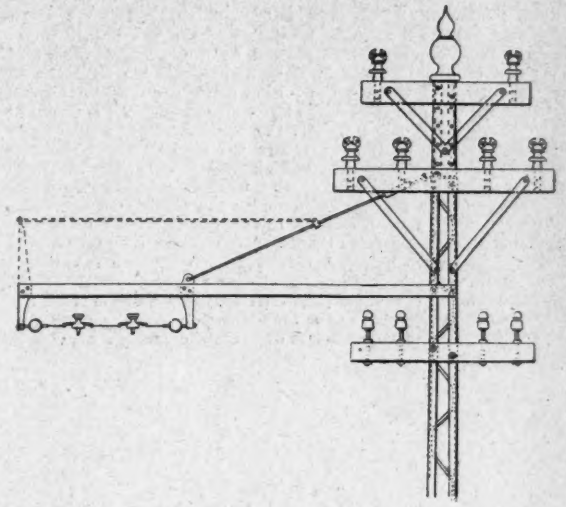
To-day's Events.—Friday, May 10th.—At 8 p.m. Physical Society. Meeting at the Physics Laboratory of the Royal College of Science, Imperial Institute Road, South Kensington. Dr. T. C. Porter—Stereoscopy with long base-line, illustrated on the screen.

Monday, May 13th.—Institution of Mechanical Engineers Graduates' Association. Meeting. Paper by Mr. C. C. B. Morris, graduate, on "Petrol Motor-Omnibuses." Mr. H. Graham Harris in the chair.

Thursday, May 16th.—At 8 p.m. Institution of Electrical Engineers. Extra meeting at the Society of Arts. If the discussion on Messrs. Cohen and Shepherd's paper was concluded last night, the following paper will be read and discussed:—"The Present State of Direct Current Design as Influenced by Interpoles," by Messrs. F. Handley Page and Fielder J. Hiss, students.

At 8.30 p.m. Chemical Society. Ordinary meeting at Burlington House.

Saturday, May 18th.—At 3 p.m. Junior Institution of Engineers. Visit to the scientific instrument works of Messrs. W. F. Stanley & Co., and to the Stanley Technical Schools, at South Norwood.



COMBINED LATTICE TRAMWAY AND TRANSMISSION POLE, MONTEVIDEO TRAMWAYS.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

THE following orders are issued:—

Monday, May 13th.—"A" Company, infantry drill competition, 7.30 p.m.
Tuesday, May 14th.—"B" Company, infantry drill competition, 8 p.m.
Wednesday, May 15th.—"D" Company, infantry drill, 7 p.m.
Thursday, May 16th.—"C" Company, infantry drill competition, 8 p.m.
Friday, May 17th,—"D" Company, infantry drill competition, 7.30 p.m.

J. H. S. PHILLIPS, Captain, for Adjutant on leave,
Electrical Engineers R.E (V.).

Proposed Reunion of Active Service Members E.E.R.E. (Vols.).—Owing to the difficulty of getting into touch with the old members we shall be glad if all those in sympathy with the proposal will kindly send in their names and present addresses on a postcard together with any suggestions they may desire to make, and also bring this request to the notice of any old members they may know who otherwise may not hear of this.

COXON, DALLISON & MASON,
Provisional Committee.

C/o THE ELECTRICAL REVIEW,
4, Ludgate Hill, London, E.C.

NOTES.

Electrically-Driven Paper Mill in Japan.—According to the New York *Electrical Review*, the representatives of the Oji Paper Co., of Tokio, Japan, have for some time been inspecting various electrical properties in the United States with an eye to installing a modern electrically-equipped paper mill in Japan. As a result of their investigations, orders have been placed in the United States for a very complete electrical and mechanical equipment costing over a million dollars. The new Japanese paper mills, which will be operated by the electric drive, will include, in addition to the motor equipment of the paper-making machinery, a new hydro-electric plant, with a 15-mile transmission line and sub-station. The electrical equipment will be furnished by the General Electric Co., U.S.A. At the power station there will be installed four water-wheel-driven three-phase 3,125-kilovolt-ampere units, generating current at a pressure of 3,450 volts, and at a frequency of 60 cycles. Current for exciting the revolving fields of these generators will be furnished by the usual twin exciting units, consisting of two 150-KW. generators, driven respectively by an induction motor and a small water-wheel. Generator regulation will be effected by a Tirrill regulator. Twelve water-cooled, step-up transformers will be arranged in sets of three to raise the

generator voltage for transmission. Each transformer will have a capacity of 1,050 KW., and the primary voltages will be arranged with Y connections for either 46,000 volts, 45,000 volts, or 44,000 volts. An eight-panel switchboard embodying the standard practice of the General Electric Co. will be installed in the main station. At the sub-station near the mill, 12 step-down transformers will be employed to reduce the pressure to 2,200 or 2,100 volts. The switchboard will be arranged to distribute power at the desired voltage directly to the motors. In the paper mill five 750-H P. 2,000-volt induction-motors will be used to drive the pulp grinders. These motors are known as form M, having an external resistance in the rotor circuit and controllers to vary the speed. Each motor will have an extended shaft, and will be so placed between two pulp grinders that both grinders can be driven directly without belting. Four beater machines are to be driven, each by a 350-H.P. induction-motor operating at a pressure of 2,000 volts. A fifth will be driven by a 200-H P. induction-motor, and all will be operated on the rope-drive system. The Oji paper mill will be situated at Hokaido, on the seashore facing the Pacific.

Fire in San Francisco Electric Station.—We learn that on April 2nd the generating station of the San Francisco Gas and Electric Co. was seriously injured by fire. The wooden roof over half the main building was burnt out, and the steel trusses of the other half warped, the falling *débris* causing considerable damage to the boilers and steam pipes and plant. As a result of the steam header being broken, the steam plant was practically shut down for some days. A theory has been advanced that the fire was due to the dropping of a high-tension cable carrying 11,000 volts, causing a breakdown of the insulation where the mains passed out of the power station under the roof. On the other hand, it has been reported that the boilers had been fired very hard for some considerable time, and the smoke stacks had been observed to be red hot. A neighbouring watchman saw flames pouring from the stack before the wooden roof was actually ablaze. Notwithstanding the suggestion, therefore, that the origin of the fire was due to the breakdown of a high-tension main, the more probable theory is that it was due to overheated chimney stacks.

Smoke: The Need for Electric Radiators and Cookers.—Dr. Collingridge, the Medical Officer of Health for the City of London, in his annual report which has just been issued, says:—"Judging from the number of complaints received, there appears to have been a marked improvement of recent years in the reduction of smoke nuisances from business premises, but this can only partially remedy the evil so long as no action can be taken with regard to smoke from domestic premises, and it is very doubtful whether it would be practical to deal with these by legislation. Much of the improvement noted in the case of premises where motive power is required is due to the substitution of electricity for steam as a generating force, but until electricity is supplied at considerably less cost than at present, it will be but sparingly used, either for heating or cooking purposes."

The Copper Trade of the United States.—According to the *Engineering and Mining Journal*, the amount of copper imported, used, and exported during 1905 and 1906 was as follows, the figures for November and December, 1906, being estimated:—

	1905.	1906.
Stock on January 1st	208,376,672 lb.	128,980,000 lb.
Importation	210,724,685 lb.	225,000,000 lb.
Manufacture	871,634,245 lb.	915,000,000 lb.
Totals	1,290,735,602 lb.	1,268,980,000 lb.
Exportation	548,772,403 lb.	472,870,000 lb.
Stock on December 31st ...	128,980,000 lb.	135,570,000 lb.
Total consumption ...	612,983,199 lb.	660,540,000 lb.

Electric Shock Fatalities.—At the inquest held last week at Middlesbrough into the circumstances of the death of Wm. Tye (28), Warren Street, which occurred at the Acklam Ironworks, as reported last week, Jas. E. Onions, assistant foreman engineer, deposed that he saw deceased, who was in the smith's shop, take hold of an iron bar. Witness was looking through the window. A moment later, whilst Onions had his back to the window, he heard a shout, and on turning round, saw deceased, who was in a very peculiar attitude. Witness called for assistance, and sent a man to turn off the current. When Tye was released, artificial respiration was resorted to, but this was ineffective. Within about 2 ft. of where he was there was a switchbox, but, as far as witness's experience went, he did not think this would have given deceased a shock. When found, the latter had also hold of a piece of plate, and when he was got off this it was noticed that the plate had caught on to a wire. The bar was not touching the wire, which was properly insulated. Witness did not examine the wire to see if the insulation was complete.

At this juncture a coil of the wire was handed round for inspection, and it was noticed that a splinter of the plate had penetrated through the insulation.

Wm. Wilson, foreman joiner, said he noticed deceased standing up in the smith's shop. He had his right arm round the plate, which was sparking at one of the bottom corners. He, in company with the last witness, secured some broom-shanks, and with these they attempted to prise off deceased.

Mr. R. A. Sherwood, electrician at the works, said the wire was insulated in the ordinary way, and was in very good condition. Witness's explanation of the occurrence was that the splinter, which he thought was a rag off the edge of the plate, had cut completely through the insulation. In answer to questions put by Mr Dunnolly (H.M. Factories Inspector), witness stated that it would depend on circumstances as to whether the current that came through the splinter was strong enough to kill a man. In this instance deceased had evidently been grasping an iron bar at the same time that he held the plate. The voltage was 250. Witness himself had received a charge of that kind. He did not think the sparking of the plate would increase the shock.

The medical evidence was that the cause of dea'h was stoppage of the heart consequent upon an electric shock. Verdict accordingly.

According to the *Glasgow Evening Times*, an accident occurred on April 29th in the testing room of the British Westinghouse Works at Trafford Park, Manchester, whereby a former student of the Glasgow Technical College lost his life. Mr. Robert H. Gardner was in charge of some operations there, and was found lying unconscious with his hands in contact with live wires. Every effort was made by the staff to restore animation, but without avail, and death must have been instantaneous. Well known in shipping circles, he had passed with distinction through the Technical College, and was well through his apprenticeship with the British Westinghouse Co.

Last month Nicholas Pereira, a fitter, aged 28 years, was killed by an electric shock at the electric power generating station at Wari Bunder. He received instructions from the engineer to connect some cables in the switch cell chamber. "Instead of attending to this he appears to have occupied himself with chiselling out a hole in the dividing wall of the chamber, where by some chance he came in contact with the live cable. He had two holes burnt in his right thigh and right side, and died in about 20 minutes."

Mr. A. M. Simpson, resident engineer, Brush Electrical Engineering Co., who was in charge of the construction work of the power house, said there were very few dangerous places in the power house. The live cells were practically the only places where workmen would be in danger in the power house. Warnings had been given by witness personally to the deceased about the danger of working too near the live wires, and to exercise great care and to work on the wall on the side opposite the live cells. A hole had been made in the wall by somebody and an iron fitted in it, but the deceased was apparently not satisfied with it. He had no orders to alter it. He was wireman fitter, and was carrying out cable work in connection with the extension of the switchgear. This was to operate all tramcars, lighting and motive power over Bombay. The pressure in the live cells was extra high, 5,500 volts. He was fiddling with another man's work. He had been ordered to do the cable at the other (right hand) side of the blank cell. The cells to the left of the blank cell were the live ones. The deceased had been 12 months at the work, and had been trained by the side of a European expert, and worked under his immediate directions.

The jury returned the verdict that the death of the deceased was due to shock from electricity, caused by an accidental fall on to live wires while working at the power house.

According to the *Tribune* an inquest was held at Hatcham, on 3rd inst., touching the death of William Tomalin, 37, of 24, Snead Street, Deptford. On Tuesday he was working at the Asylum Board's fever hospital, New Cross, and had occasion to use an electric lamp. He was seen to fall, and it was supposed that, there being a defect in the lamp, he had received an electric shock which caused his immediate death. The jury returned a verdict of "Accidental death, caused by a defective electric lamp."

The Wilkinson Live-Steam Feed-Water Heater.—A letter by Mr. John I. Hall, in our contemporary *Engineering*, states that in some tests at Messrs. Rowntree's works at York, the feed-water and steam temperatures were found to be identical, both when the feed water was first heated to 210° F. in the economiser, and when it was taken from the hot well at 115° F. Mr. Hall also counters an objection against the Wilkinson type of heater, which suggests that the creation of a cold zone around it in the steam space involves the risk of wet steam in the steam pipe, by feeding the live-steam feed heater with cold water at 60° F., and measuring the boiler shell temperatures at varying distances from the centre of the heater. These investigations only revealed a maximum variation of 3° F., which, Mr. Hall states, "is not to be compared to the disparity between steam and feed water from economisers, which is usually about 100° F. below steam temperature."

Institution and Lecture Notes.—LONDON ASSOCIATION OF FOREMEN ENGINEERS AND DRAUGHTSMEN.—On Saturday last, May 4th, the annual banquet of the above Association was held at the Cannon Street Hotel, when some 250 gentlemen connected with the engineering profession were present. Mr. Rosenthal (Messrs. Babcock & Wilcox) occupied the chair, being supported among others by Sir A. John Durston, K.C.B., Engineer-in-Chief to the Royal Navy, Mr. John Dewrance, and representatives from kindred associations in Glasgow, Birmingham, Leeds, Middlesbro' and Woolwich. After the usual loyal toasts, the chairman proposed that of the Association, and said the success of all engineering firms was greatly dependent upon the manner in which foremen and managers carried out the wishes of the directors; and he appealed to those present to support generously the superannuation fund of the Association. Mr. T. Mullock, the secretary, responding to this, gave particulars of the large amount already paid away by the Association. In reply to the toast of "Donors," proposed by Mr. Watkinson, M.I.M.E., Mr. John Dewrance said he felt the Association was of the utmost importance to employers. He himself had been connected with it for many years, and he asked other employers in the engineering industry of the Metropolis to come forward and help if they had not already done so.

Electrical Surveyors' Society.—A meeting of this newly-formed Society, which consists of the experts attached to the various fire insurance companies, was held on April 29th. Mr. S. G. Castle Russell, M.I.E.E., presided, and was supported by the hon. secretaries, Mr. Bertram Chatterton, A.M.I.C.E., and Mr. Arthur C. Cockburn, M.I.E.E, F.C.S., and by a large attendance of members. A discussion took place upon the question of earthing metallic conduit wiring systems. The opinion of the meeting was taken, and it was unanimously agreed that efficient earthing of metallic conduit systems throughout their entire length was advisable.

Faraday House Old Students' Associaton.—The third annual dinner of this Association was held at the Queen's Hotel, Leicester Square, on Friday, 3rd inst. Amongst those present were Mr. Robert Hammond, the Patron, Major O'Meara, chief engineer to the Post Office, Mr. C. P. Sparks, M.I.E.E., Mr. Hugo Hirst, M.I.E.E., Mr. John H. Rider, M.I.E.E., Mr H. E. M. Kensit, M.I.E.E. (vice-president), Mr. Howard Foulds, hon. secretary, and members and friends to the number of 110. As is customary at these dinners, the speeches were of the briefest description, the evening being completed by an excellent musical programme, the artistes including, amongst others, Mr. Harrison Brockbank, Mr. George Robins, Dr. Byrd Page, and Miss Agnes Gordon.

Bermondsey Electric Lighting.—The following letter comes to hand too late for insertion in "Correspondence" columns:—

"The Corporation of the Borough of Bermondsey applied to the Board of Trade last December for a provisional order under the Electric Lighting Acts in respect of the portion of the borough heretofore known as the St. Olave district. The Board of Trade having recently refused the application, a Committee of the Corporation has issued a report regretting the result, 'because the Council had lost a profitable portion of the borough, and because the inhabitants of that portion will not be able to get a cheap supply of electric energy.'

"As this report has been published, it is important that the true facts should be made known.

"My company and the London Electric Supply Corporation are supplying energy in the St. Olave District, and the decision as to the grant of the order depended upon the answer to the question whether the corporation or the companies could give the cheaper supply, and the refusal of the order asked for by the Corporation was based upon the evidence given that we could and were, in fact, giving a cheaper supply in the St. Olave District than was given by the Corporation in the adjoining district, or proposed to be given by them in the St. Olave District.

"H. B. Renwick,

"*Secretary, the County of London Electric Supply.*

"London, E.C., *May 7th*, 1907."

Appointments Vacant.—Resident electrical engineer for Wrexham (£200).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Tunbridge Wells T.C. on May 1st adopted the recommendation appointing Mr. Horace Boot as consulting electrical engineer, mentioned in the Electrical Review last week. The recommendation was carried by 19 votes to 8, an amendment that Mr. Boot should pledge himself to be four days a week in the town being lost. Mr. Boot, who has been with Tunbridge Wells Corporation for the past 12 years, was approached by several Corporations and companies to advise them from time to time. We understand that it is Mr. Boot's intention to continue to practise as a consulting engineer, with offices in London, in order to advise Corporations and companies with respect to installing and carrying on electricity undertakings.

Mr. Thomson, manager of the gas, water and electricity works at Kendal, has been appointed gas and waterworks engineer at Ramsgate.

The recommendation to increase the salary of Mr. J. R. P. Lunn, electrical engineer at Stockton-on-Tees, by £50 a year, was adopted by the T.C. on May 2nd.

Mr. Sillery, borough electrical engineer, Wrexham, has been appointed to a similar position at Partick, Glasgow.

At the meeting of the Belfast Tramways and Electric Committee, on Monday, Mr. Thos. W. Bloxam, A.M.I.C.E., was appointed electrical engineer to the Corporation, in succession to Mr. V. A. H. M'Cowen who has been appointed electrical engineer to the Salford Corporation. In 1893, Mr. Bloxam was appointed electrical engineer in charge of the electricity works of the Great Eastern Railway Company, London, where he had the supervision of plant up to 1,200 H.P. In 1897, he was appointed chief assistant engineer at the County of London and Brush Provincial Electric Light Co.'s Works, Wandsworth, and two years later he was appointed to a similar position to the Dover Electricity Supply Co. Nearly eight years ago he was appointed assistant manager to the Belfast Corporation's electric undertaking.

Mr. J. C. Whiteley has resigned his position as chief assistant engineer at Huddersfield, and taken up duties as assistant manager with the Chatham and District Tramways Co.

Mr. R. H. Fenwick has resigned his position of shift engineer at the Eccles Corporation Electricity Works, in order to take up the post of charge engineer at the Beckenham electric lighting and traction station. Mr. Fenwick, before leaving Eccles, was presented with a case of pipes by the staff and employés of the electricity department. Mr. E. J. Gilbert, station superintendent, made the presentation, in the unavoidable absence of the borough electrical engineer, Mr. H. W. Angus.

General.—It is announced that the Postmaster-General has appointed Mr. J. W. Woods and Mr. A. J. Stubbs, Superintending Engineers, to be additional Assistant Engineers-in-Chief of the Post Office.

Mr. F. Edmondson has been appointed general manager and engineer of the Manx Electric Railway Co., Ltd., in succession to Mr. Harold Brown, who is leaving for Canada.

According to the *Review of the River Plate* of April 12th, at a recent meeting of the Institution of Engineers of the River Plate, an illuminated address was presented to Mr. Ernest Danvers, M.I.E.E., "in view of his forthcoming departure for Europe, and as a mark of appreciation for the long and valuable services rendered to the Institution by him since its foundation. He was the second president of it, and had been acting as hon. secretary and treasurer for many years."

Mr. D. H. Ogley, of Stafford, has been appointed Assistant Lecturer in Electrical Engineering at the Royal Technical Institute, Salford, to fill the vacancy recently advertised in this journal.

Mr. H. R. Beeton, of 18, Austin Friars, has been appointed a director of the Chelsea Electricity Supply Co., Ltd.

Mr. R. Humphries, of the Malta tramways, has now reached this country, and his present address is 36, Elm Grove, Peckham, London, S.E.

On Wednesday a travelling bag and a silver-mounted walking-stick were presented by the staff of the electricity works, Bo'ness, N.B., to Mr. F. E. Trott, who is leaving to take up a more lucrative position at the electricity and tramway station, Kirkcaldy, N.B.

Obituary.—It is reported that Mr. Nathaniel Parks, an associate of the late Mr. Cyrus W. Field in the laying of the first cable across the Atlantic, has died at Deansboro, New York, at the age of 82.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Durham Collieries Electric Power Co., Ltd. (83,421).—A trust deed dated March 18th, 1907, to secure £150,000 debentures, has been registered. Property charged: Land in Newbottle, Houghton-le-Springs, Durham, forming the site of the company's power station and reservoir, the easement or right to lay and maintain cable and pipe lines over lands belonging to the Ecclesiastical Commissioners, certain land in Coverhole, Durham, together with rights to pump water and maintain water mains; the right to lay and maintain a cable between the power station, Harraton and North Biddick, Durham; 14,993 fully-paid £1 shares in the Houghton-le-Spring and District Electric Lighting Co., Ltd.; the sum of £7,683 2s. 11d. secured by a certain instrument of charge: £10,000 debentures, 6,000 fully paid preference shares and 8,000 fully-paid ordinary shares of £1 each in the Sunderland and District Electric Tramways, Ltd., and the company's other assets, present and future, including uncalled capital. Trustees: Trustees, Executors and Securities Insurance Corporation, Ltd., Winchester House, E.C. A memorandum of satisfaction in full of a charge dated January 25th, 1906, securing £75,000, has also been registered.

British Columbia Electric Railway Co., Ltd. (51,953).—This company's annual return, made up to November 20th, 1906, was filed on February 13th, 1907. £300,000 5 per cent. cumulative perpetual preference stock, £300,000 preferred ordinary stock, and £400,000 deferred ordinary stock has been taken up out of a nominal capital of £1,500,000 in £300,000 5 per cent. cumulative perpetual preference stock, £300,000 preferred ordinary stock, £400,000 deferred ordinary stock, and 500,000 shares of £1 each. £200,000 deferred ordinary stock is considered as fully paid, and £837,088 13s. 2d. has been paid on the remainder, including £1 15s. paid on seven forfeited shares (? and including premiums). Mortgages and charges at date of return: £458,000. (Trust deed to secure perpetual consolidated debentures not exceeding the amount of the paid-up capital, created February 14th, subsequently registered.)

Charing Cross, West End and City Electricity Supply Co., Ltd. (29,122).—This company's annual return was filed on March 26th, when 80,000 preference, 80,000 ordinary, 80,000 City undertaking preference and 70,000 City undertaking ordinary shares had been taken up out of a nominal capital of £2,100,000 in 130,000 preference, 130,000 ordinary, 80,000 City undertaking preference and 80,000 City undertaking ordinary shares of £5 each. £5 per share has been called up on 80,000 preference, 80,000 ordinary and 80,000 City undertaking preference shares, resulting in the receipt of £1,200,000. £350,000 is considered as paid on 70,000 City undertaking ordinary. Mortgages and charges: £445,736 4 per cent. debenture stock and £472,000 City undertaking 5 per cent. debenture bonds.

Oxford Electric Co., Ltd. (34,685).—This company's annual return was filed on March 22nd, when 20,000 ordinary and 3,000 preference shares had been taken up out of a nominal capital of £150,000 in 20,000 ordinary and 10,000 preference shares of £5 each. £5 per share has been called up on 16,200, resulting in the receipt of £81,000. £35,550 is considered as paid on 7,110. Mortgages and charges: £50,000.

Thompson, Ritchie & Co., Ltd. (electrical engineers, London) (35,835).—£600 debentures, created March 19th and dated March 20th, 1907, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. No trustees.

A. Reyrolle & Co., Ltd. (70,210).—This company's annual return was filled on March 15th, when the entire capital of £20,000 in £1 shares (8,000 preference and 12,000 ordinary) had been taken up. £1 per share has been called up on 8,000 preference and 5,000 ordinary, resulting in the receipt of £13,000. £7,000 is considered as paid on 7,000 ordinary. Mortgages and charges: Nil.

Telegraph Construction and Maintenance Co., Ltd. (1,147 c).—This company's annual return was filed on March 22nd, when the entire capital of £448,200 in 37,350 shares of £12 each had been taken up and paid for in full. Mortgages and charges: Nil.

Bath Electric Tramways, Ltd. (74,278).—This company's annual return was filed on April 12th, when 75,000 preference, 75,606 preferred ordinary, and 30,000 deferred ordinary shares had been taken up out of a nominal capital of £230,000 in 75,000 5 per cent. cumulative preference, 125,000 preferred ordinary, and 30,000 deferred ordinary shares of £1 each. £1 per share has been called up on 75,000 preference and 75,606 preferred ordinary, resulting in the receipt of £150,606. 30,000 deferred ordinary are considered as fully paid. Mortgages and charges: £157,900.

James & Browne, Ltd. (electricians, &c., Hammersmith), (72,372).—Issue on March 26th of £250 5 per cent. debentures, part of series created June 29th, 1906, to secure £6,000 charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: J. W. Ellis, Portland House, Basinghall Street, E.C.; and E. Hughes, 106, Holland Road, Kensington. Previously issued of same series: £4,450.

Northampton Electric Light and Power Co., Ltd. (28,640).—This company's annual return was filed on March 21st, when 10 "A," 36,604 "B" ordinary and 25,040 "B" preference shares had been taken up out of a nominal capital of £100,000 in £1 shares (10 "A" and 99,990 "B"). £61,654 has been received. Mortgages and charges: £47,800.

South Metropolitan Electric Light and Power Co., Ltd. (47,875).—This company's annual return was filed on March 20th, when 120,000 ordinary and 117,968 preference shares had been taken up out of a nominal capital of £300,000, in 150,000 ordinary and 150,000 preference shares of £1 each. £1 per share has been called up on 117,500 ordinary and 112,600 preference, resulting in the receipt of £230,100. £7,868 is considered as paid on 2,500 ordinary and 5,368 preference. Mortgages and charges: £237,968.

Hart Accumulator Co., Ltd. (60,059).—This company's annual return was filed on March 25th, when 40,000 ordinary and 7,059 preference shares had been taken up out of a nominal capital of £60,000 in £1 shares (20,000 preference). £1 per share has been called up on 17,500 ordinary and 7,059 preference, resulting in the receipt of £24,559. 22,500 ordinary shares are considered as fully paid. Mortgages and charges: Nil.

Westminster Electric Supply Corporation, Ltd. (27,061).—This company's annual return was filed on March 20th, when 110,000 ordinary and 81,279 preference had been taken up out of a nominal capital of £2,000,000 in £5 shares (200,000 4½ cumulative preference). £5 per share has been called up, resulting in the receipt of £956,395. Mortgages and charges: £250,000.

Supplies, Ltd. (Electricians, Liverpool), (82,737).—Issue on April 17th of an £800 5 per cent. debenture, part of series created same date, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

London United Tramways, Ltd. (71,844).—An acknowledgment of indebtedness, dated April 8th, 1907, creating £918,930 further mortgage debenture stock (making with £1,331,000 already created a total of £1,649,930), supplemental to a trust deed dated February 26th, 1902, and to three acknowledgments of indebtedness, one dated July 28th, 1903, and two dated June 13th, 1905, securing such previous issues, has been registered. Property charged: Certain freehold properties, consisting of land at Turnham Green, with the power station, car sheds, stables, tramway lines and erections, forming the company's Chiswick power station and depôt, land at Acton and Richmond, with car-sheds and erections thereon, forming the company's Acton and Richmond depôts; land at Hanwell and Hounslow, with buildings thereon, forming the company's Hanwell and Hounslow sub-stations, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Rt. Hon. Lord Revelstoke and Sir George White, Bart.

Notting Hill Electric Lighting Co., Ltd. (25,921).—This company's annual return was filed on March 15th, when 10,852 ordinary, 2,998 "ordinary preference," and 550 founders' shares had been taken up out of a nominal capital of £200,000 in 16,452 ordinary, 2,998 "ordinary preference," and 550 founders' shares, of £10 each. £10 per share has been called up, resulting in the receipt of £144,000. Mortgages and charges: £64,000. Ditto guaranteed jointly by this company and the Kensington and Knightsbridge Electric Lighting Co., Ltd., and issued under the Kensington and Notting Hill Electric Lighting Companies' Act, 1899: £178,400.

Kensington and Knightsbridge Electric Lighting Co., Ltd. (26,193).—This company's annual return was filed on March 21st, when 21,000 ordinary, 10,000 first preference and 10,000 second preference shares had been taken up out of a nominal capital of £350,000 in £5 shares (50,000 ordinary, 10,000 first preference and 10,000 second preference). £5 per share has been called up on 15,968 ordinary, 10,000 first and 10,000 second preference shares, resulting in the receipt of £179,840. £25,160 is considered as paid on 5,032 ordinary. Mortgages and charges: £90,000. Ditto in respect of debenture stock issued by this company in conjunction with the Notting Hill Electric Lighting Co., Ltd.: £178,400.

London Electric Supply Corporation, Ltd. (24,957).—This company's annual return was filed on March 14th, when 111,000 ordinary and 69,840 preference shares had been taken up out of a nominal capital of £1,050,000 in 200,000 ordinary shares of £3 each and 90,000 preference shares of £5 each. £3 per share has been called up on 111,000 ordinary and £5 per share on 69,840 preference, resulting in the receipt of £682,360, including £160 paid on 160 forfeited shares. Mortgages and charges: £374,395.

Dixon & Corbitt and R. S. Newall & Co., Ltd. (24,228).—This company's annual return was filed on April 5th, when 6,000 ordinary, and 1,956 preference shares had been taken up out of a nominal capital of £120,000 in 6,000 ordinary, and 6,000 preference shares of £10 each. £8 per share has been called up on 1,706 preference, and £13,648 has been received. £62,500 is considered as paid on 6,000 ordinary, and 250 preference. Mortgages and charges: £33,100 debentures, and £4,000 mortgages.

Bradbury & Co., Ltd. (8,327).—This company's annual return was filed on April 16th, when 12,631 shares had been taken up out of a nominal capital of £90,000 in 15,000 shares of £6 each. £6 per share has been called up, and £83,073 has been received, including £7,287 paid on 995 forfeited shares. Mortgages and charges: £84,988 debenture stock. A receiver was appointed in August last.

Davies, Kent & Stewart, Ltd. (81,627).—This company's annual return was filed on April 19th, when 1,974 preference, and 1,000 ordinary shares, have been taken up out of a nominal capital of £3,500 in 2,500 preference, and 1,000 ordinary shares of £1 each. £2,974 is considered as paid. Mortgages and charges: £1,050 debentures.

Controls, Ltd. (90,700).—This company's statutory report, made up to March 26th, was filed on April 5th, when seven shares had been taken up and paid for in full out of a nominal capital of £2,000 in £1 shares. No mortgages or charges registered.

British United Engineering Co., Ltd. (86,682).—This company's annual return was filed on April 25th, when 9,882 ordinary and 370 preference shares had been taken up out of a nominal capital of £25,000 in 10,000 ordinary shares of £1 each and 3,000 preference shares of £5 each. £1 per share has been called up on 4,882 ordinary and £5 per share on 370 preference shares, and £6,729 has been received, leaving £3 in arrears. £5,000 is considered as paid on 5,000 ordinary shares. Mortgages and charges: £2,200. Issue on April 22nd of £300 6 per cent. debentures, part of series created January 10th, 1907, to secure £10,000, charged on the company's property, present and future, including uncalled capital. No trustees. Previously issued of same series: £2,200.

Miners' Lamp Electric Lighting Co., Ltd. (28,019).—This company's annual return, made up to August 20th, 1906, was filed on February 26th, 1907; 300 shares have been taken up out of a nominal capital of 3,000 in £5 shares; £5 per share has been called up on 110, resulting in the receipt of £550; £950 is considered as paid on 190. Mortgages and charges: Nil.

British Power Co., Ltd. (64,780).—This company's annual return, made up to December 31st, 1906, was filed on March 28th, 1907; 6,265 shares have been taken up out of a nominal capital of £250,000 in £10 shares; £62,650 has been received. Mortgages and charges: £35,900.

Chatham, Rochester and District Electric Lighting Co., Ltd. (24,773).—A memorandum of satisfaction in full of a mortgage debenture dated June 12th, 1901, securing £9,000, has been filed.

CITY NOTES.

West India and Panama Telegraph Co., Ltd.

THE report for the half-year ended December 31st, 1906, says that the amount to credit of revenue is £34,203, against £28,032 for the corresponding half-year of 1905. The expenses have been £21,612, against £23,232, leaving a balance of £12,592, to which is added £1,548 interest on investments and £313 brought forward from last account, making a total of £14,452. It is proposed to pay 8s. per share on the first preference shares, being 2s. balance of arrears—£3,456—and 6s. dividend six months to December 31st, 1906—£10,369, leaving a balance to current half-year's account of £627. The traffic receipts for the six months show an increase of £5,461, as compared with those for the corresponding period. The shareholders will remember that in May, 1902, the Dominica-Martinique and Martinique-St. Lucia cables were interrupted and partly destroyed by the eruption of Mont Pelé, Martinique, and that, owing to the subsequent volcanic disturbances, it was thought desirable to postpone the work of repairing them. The directors now report that, in March last, the work of restoration was effected, the two cables being joined up into one between Dominica and St. Lucia, instead of being landed at Martinique. The cost will appear in the next half-yearly accounts. The completion of this work re-establishes the duplication of the company's cables between Cuba and Trinidad. The disastrous earthquake which occurred in January last, in Jamaica, destroyed the company's office and several miles of the land-lines in and near Kingston. Fortunately, the members of the staff, with one exception, escaped personal injury; and, owing to their prompt and energetic action, telegraphic communication was re-established within a few hours. A temporary office was opened at Bull Bay, a few miles outside the town and beyond the limit of the devastated area, thus affording the Governor and public of Jamaica the only telegraphic means of communicating with the rest of the world at the time of the catastrophe and during the events which followed. The Jamaica-Colon cable was also interrupted by the earthquake, and has since been repaired. Fortunately the company's four cables, which land at the eastern end of the island, were uninjured. Telegrams relating to the Mansion House Relief Fund were transmitted free of charge over the cables of this and connecting companies. Certain losses have been sustained by the staff in Kingston owing to the partial destruction of their homes; and, at the meeting, the shareholders will be asked to sanction payment of them.

Perth (W.A.) Electric Tramways, Ltd.

THE eighth ordinary general meeting of the company was held on May 2nd at Salters' Hall Court, Cannon Street, Mr. Allen P. H. Stoneham presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, April 26th, page 691), said he again had to congratulate the shareholders on a satisfactory balance-sheet, but, as they knew, the greater the traffic the greater was the necessity for increased capital expenditure, increased traffic meant more cars, larger sheds, and more turnouts from the track. From the comparative summary of accounts they would see that their profits during the last four years, if they could have drawn the cash, would have been sufficient to enable them to pay much larger dividends than they had been able to recommend, but they had had to expend the money on capital purposes, and thus deprive themselves accordingly of dividends. But what could they do? They desired to please their shareholders, and they must please their customers—the travelling public, and they must please the local authorities without whose goodwill they could not succeed. The result was that the shareholders had to provide more capital, which was not easy when no one was investing, or else give up part of their profits and reinvest them in cars and extensions instead of utilising them for dividends. The latter was the course they had adopted—a course they had been compelled to adopt to please their customers. They had to pay income-tax on those profits just the same as if they had received them, whereas much of it had gone on capital outlay. They had spent upwards of £22,000 in that way, and paid £1,100 income-tax upon it, although they had not touched a single penny of it. It did seem rather hard, for although the dividend was 5 per cent., it amounted to less than 1 per cent. per annum since the formation of the company, but had they been able to divide all they showed as made in the profit and loss account of the last four years, the ordinary shareholders would have received on an average 4 per cent. instead of 1 per cent. However, there were harder cases than theirs. Perth was a growing city, and they must

devise some means of providing capital, unless it was to come out of revenue, and they were to be deprived of their dividends. They were all averse to increasing the capital of the company, but they hoped next year to submit some scheme for the consideration of the shareholders. It would probably be that they would form an auxiliary company, but they might depend upon it that whatever they recommended would be carefully considered in the interests of both classes of shareholders. They would remember that the directors were asked to obtain a quotation for shares of both classes on the Stock Exchange. They had obtained a quotation for the ordinary shares, but they were advised that it was useless to apply for a quotation for the preference shares, as they were held in large blocks, and until they were more distributed, it would be useless to apply. He hoped that before long a satisfactory arrangement would be made by which a sufficient number of preference shares would be offered for sale for the purpose of obtaining a Stock Exchange quotation. When the company was formed, they would remember it was very difficult to raise the capital, and unless he and a few sanguine persons had come to the rescue, the concession would have been forfeited. The concession was hawked about the city for months, and had he not found the first capital, there would have been no tramway, and the concession would have elapsed. At that time the estimated profits to be made varied from £16,000 to £30,000 a year, and London financiers scouted the idea that £16,000 would ever be made, but last year the profits were £35,000. Those profits would never have been made had they kept to the rule of spending the exact sum on capital originally intended. They originally intended to build 17 miles, but they now had 26 miles, and the principal factor in their success was the building of the 2¾ miles in Subiaco, and their success had been made through the suburban extensions during the last four years, during which time their profits had increased 350 per cent. The suburban extensions were the only way to make success.

Mr. Charles Wren seconded the motion, and the report was adopted.

Auckland Electric Tramways Co., Ltd.

Mr. C. G. Tegetmeier presided on Tuesday at the annual meeting held at Donington House

In moving the adoption of the report (see Electrical Review, May 3rd, p. 735), he said that the traffic receipts represented an average of £6,800 per route-mile, an increase of about £300 per route-mile over the previous year. They had carried the whole of the population more than 300 times in the year, which was exceptional in the record of tramway undertakings. Progress in this direction still continued. The increased business done in 1906 had not been accompanied by any material increase in expenses, for the average expenses per passenger showed a decrease, while the average receipts per passenger showed a slight increase. Although the expenses under all heads were very much greater than in similar undertakings in this country, the proportion of expenses to receipts worked out at the very satisfactory figure of 55 per cent., a reduction of 3 per cent. as compared with the preceding year. At the close of the year they had 60 cars in stock, an increase of five. At the last annual meeting he stated that they had not sufficient cars in stock, and that some months previously they had ordered five more cars. Shortly after this they ordered five further cars, which would bring the total number up to 65. At this time last year they fully expected that some, at least, of these 10 cars would be speedily available for service in Auckland; but unforeseen delays occurred, both in this country, where they obtained the trucks and electrical equipment, and in Auckland, where it had been their policy to get the car bodies built, and it was not until the latter months of the year that the first five of these cars were available for carrying traffic. The delay had been very unfortunate, especially in view of the remarkable and continuous, and unforeseen developments of the traffic. They were taking effectual steps to avoid any shortage of rolling stock in the future. In the course of a few months the total number of cars would be increased to 72. The expenses showed little variation from those of the previous year. Power and running expenses had increased by £1,139 owing to the increased mileage run. Repairs and maintenance showed a decrease of £639, and administration and general expenses a decrease of £400. The rental and percentage of profits payable to the Auckland City Council had increased from £2,683 to £3,246. The Council were entitled to a percentage on the profits available for distribution, made within the City. In future it was proposed to adopt a new method, which would differentiate with more exactness between the receipts within the City and the receipts outside the City. The important question of the amount to be set aside to meet depreciation and renewals had had very serious consideration. He did not think there had been sufficient experience of electric traction to enable them to say with any exactness what proportion of the receipts or of the amount per car-mile run should be set aside annually to meet renewals and depreciation, as distinct from ordinary expenditure on repairs and maintenance; but it was obvious that provision for this purpose must be made before the net profits available for distribution could be accurately stated. The amount of such provision must necessarily depend upon the particular circumstances of each undertaking. The system at Auckland was worked to a very high degree of its capacity, and the wear and tear upon all parts of it was correspondingly great. The board considered it essential that adequate provision should be made each year for the expenditure they would have to incur in the near future upon renewals and reconstructions necessary to reinstate their depreciating assets. Last year they spent £16,915 on ordinary repairs and maintenance, which was charged to revenue. They also spent £865 on permanent-way renewals, and this amount had been charged to depreciation account. During the present year the account would be charged with very considerable expenditure in respect of the reconstruction of the track in Queen Street. The work, which was commenced in January last, was now almost, if not quite, completed. It had been very expensive, but it would prove an effectual remedy for the difficulties encountered there. The £10,000 set aside out of last year's revenue would bring the depreciation account to £41,134, and the amount represented a reasonable estimate of the requirements of the position. The reserve fund, which would be established by the application of £12,500 from last year's profits, would be available for general purposes. Since the close of the year new capital had been raised by the issue of £50,000 in 6 per cent. preference shares. The bulk of the new shares had been placed in Auckland. At the present time about £130,000 of the capital was held in Auckland by about 140 shareholders. A considerable portion of the new capital would be needed for the extensions in the Mount Eden district. They had decided to construct these as double lines throughout, and the work would be commenced as soon as the necessary preliminaries had been completed. The cost of the new cars and of the considerable addition to the plant at the power station, increasing it from 1,525 to 2,125 kw. capacity, were further items of capital expenditure to be met during the current year. Since the last meeting he had visited Auckland, and was very much impressed with the great progress that had been made there—progress which had been greatly facilitated by the company's enterprise in the development of electric tramway communication. Mr. J. J. Walklate was now on his way to Auckland to take up the position of general manager and engineer to the company. Mr. Walklate would have as his assistant in the electrical department Mr. Wilkes, who had had considerable experience of tramway undertakings in this country.

Mr. C. Shibreff Hilton seconded the motion, and, in doing so, referred to the value of Mr. Tegetmeier's services to the company in his visit to Auckland. Mr. Garcke was also there, he having been able to include Auckland in his tour. Mr. Garcke, as representing the largest shareholders in the concern, came back much impressed with what he saw and with great confidence in the future.

Gravesend and Northfleet Electric Tramways, Ltd.

Mr. W. G. Bond presided at the meeting held at the offices on Monday last week. He said that during the year there had been a marked improvement in the financial result of the company's operations. In spite of the improved showing of the undertaking, the directors had not been able to recommend an increased distribution to the shareholders. In view of the depletion of the reserve and renewals fund, the directors had considered it essential that a certain proportion of the sum carried to balance-sheet should be set aside to meet future contingencies. The depletion of the renewals fund had arisen almost entirely from the necessity for writing off the loss incurred when the company got rid of eight out of its ten bogie cars, and substituted therefor cars more suitable to the conditions which obtain in Gravesend. At the present moment they possessed 14 single-truck cars (four of them brand new), two big bogie cars and two small demi-cars. They were now, therefore, in possession of three different types of car, and were in a position to cope in the most economical manner possible with Gravesend conditions. In regard to passengers carried the year was a record one, the numbers carried being over 3,400,000, and had it been possible to maintain the average fare per passenger at the 1903 figure (their year of maximum working profit) the shareholders would have reaped a more reasonable return on the capital invested by them in the undertaking. Owing, however, to certain peculiar conditions, a much larger number of ½d. stages than would be desirable in the abstract were practically forced upon them, with the result that they carried last year more than half their passengers at a ½d.; 1,869,671 to be exact. So far the 1907 receipts had shown no signs of falling away from the 1906 standard, and if their endeavours after further economy met with success, the net outcome of the present year's working should be full of interest.

Eastern Telegraph Co., Ltd.

The directors' report states that, in accordance with the resolution of the last general meeting, they now submit the accounts for the three months ended December, 1906. The revenue for the period amounted to £326,622, from which are deducted £101,674 for the ordinary expenses, and £15,270 for expenditure relating to maintenance of cables, depreciation of spare cable, sundry differences in exchange, and income-tax payable abroad, leaving a balance of £209,678, to which is added £117,090 brought from the preceding account, making a total available balance of £326,767. After providing for income-tax payable in England, interest on mortgage debenture stock, and dividend on the preference stock, which in all absorb £42,015, there remains a balance of £284,752, out of which the directors have placed £3,500 to the reserve fund for maintenance of ships, and £150,000 to the general reserve fund. They now recommend a final dividend on the ordinary stock of 1½ per cent. and a bonus of 2 per cent., amounting together to £130,000, both payable on the 15th inst., free of income-tax, and making, with the two previous payments on account, a total distribution of 5½ per cent. for the nine months ended December 31st, 1906. It is proposed to carry forward £1,252.

Market Drayton Electric Light and Power Co., Ltd.

The directors' report for 1906 states that the company has again made progress during the year, the total connections being increased from 8,226 to 8,772 equivalent 8-c.p. lamps. The profit on working amounts to £535, which, with the balance of £346 brought forward from last year, gives a total of £881 to be dealt with. The directors propose to write off £90 from the preliminary expenses, to carry £380 to the reserve for renewal fund account, and carry forward the balance of £410. The units sold were 52,631; used on works, 18,895; and not accounted for, 3,005.

Great Northern Telegraph Co., Ltd., of Copenhagen.

From an official report of the general meeting held at Copenhagen on April 27th, we gather that the chairman and managing director, Commodore E. Suenson, D.R.N., said that in 1906 there were 20 interruptions on 11 of their cables in Europe and 12 interruptions on six of the Far East cables, exclusive of the Vladivostock-Nagasaki cables. The older of these latter was repaired in January, 1906, after two years of inactivity, whilst the other was repaired on October 1st last only. Ice, and later on the difficult and dangerous removal of the floating mines laid during the war for the defence of Vladivostock, prevented an earlier repair of this cable, which consequently remained closed for nearly 32 months. Of the three cable steamers, *H. C. Orsted* had been actively employed in Europe for 110 days, whilst in the Far East *Store Nordiske* had been on active service for 112 days—37 of which were for the account of others—and *Pacific* for 108 days, of which 11 were for the account of others. The year's cable work had thus been almost equally divided between the three steamers. Although the enforced inactivity of the Vladivostock route owing to the Russo-Japanese war, was, of course, greatly to be regretted, still it had had the advantage of leading to a material improvement of the Kiachta (Peking-Irkutsk-St. Petersburg) route, which was incontestably the shortest telegraph line between Europe and the Far East, and which ought to be the quickest as well. In fact, owing to the combined efforts of the company and the Imperial Russian and Chinese Telegraph Administrations, the service *vid* Kiachta had now been so much improved that a telegram from Peking to England was retransmitted twice only, viz., at Irkutsk, where the company's Danish staff since January 1st, 1907, had had full charge of the direct service to Peking, and at St. Petersburg, where the company's station was in direct working with Newcastle-upon-Tyne. The service with Germany (Berlin) was just as direct, whilst telegrams to London and Paris were subject to only one retransmission more. The Japanese traffic would, of course, benefit proportionately by the improved service *vid* Russia, but unfortunately the chauvinistic feelings engendered by the war had to be taken into consideration, in estimating the real effect of the improved service on the public. As a matter of fact the Japanese telegraphing public had, since the beginning of the war and up to the present date, made very little use of the routes *vid* Russia. The Iceland cable was successfully laid during the months of July and August last year by the cable steamer *Cambria*, belonging to the Telegraph Construction and Maintenance Co. The final completion of Iceland's telegraphic connection with the general system of the world took place on September 29th by the opening for traffic of the overland line between Seydisfjord and Reykjavik, the capital of Iceland. The construction of this line, which was carried out by the Icelandic Government, was exceedingly difficult owing to the hilly country, the severe climate and the absence of carriage roads. The maintenance of these internal lines might therefore prove rather difficult. No interruption of the cable had taken place as yet, although it was much exposed to injury from the numerous fishing vessels. During 1907 the company's European system would receive another important addition—viz., a new cable between Russia (St. Petersburg-Libau) and Denmark, thus duplicating the old Libau cable. The want of this duplication had been felt since the company established its own station at St. Petersburg in 1904; the new cable would therefore form a very valuable addition to the system, because it would also create a direct submarine connection with the Russian capital, thus avoiding the disadvantages often resulting from a combination of cables and long landlines. The length of the cable would be about 800 n.m.; it would be composed of exceptionally heavy types in order to withstand the dangers arising from the low depths of water in the Baltic, and particularly in the Gulf of Finland. "The contract for the manufacturing and laying of the cable has been given to the Norddeutsche Seekabelwerke, at Nordenham, not for want of confidence in our old and proved contractors, the Telegraph Construction and Maintenance Co., who have on the contrary once more proved the excellence of their work by the highly satisfactory way in which they carried out the Iceland contract last year, but solely because the German works, which enjoy an excellent reputation, twice quoted the lowest price." The cable would be laid as soon as possible after the breaking up of the ice on the Neva and in the Baltic. That the company was able to report the extension of its Russian concessions till 1926, although on less favourable terms than hitherto, was due, partly to its having agreed to establish the above new connection, which would cost a considerable amount, both in capital outlay and in working expenses, and partly to its having undertaken to work the Kiachta line from Irkutsk with an entirely Danish staff. Besides these additional expenses it would also have to bear a considerable loss through the reduction of the subsidies formerly granted as compensation for working the cables in Russia. Similar sacrifices were imposed by the Danish and Swedish Governments when the concessions in these two countries were prolonged in 1904 and 1905. The company's large receipts during the last 10 years, and the exceptional amounts paid to the shareholders as bonus for some years past, had encouraged the concessionary Governments to make increased demands. The great historical events of later years had created great difficulties for the company in its efforts to safeguard the company's interests in the Far East, particularly in China and Japan. As the pioneers of the electric telegraph in these countries they had to bear the initial risk, dangers and losses, but it would be ungrateful not to admit that, particularly during the last 10 years, the risks which shareholders ran in former days had been amply compensated for by the large dividends and the increase of the reserve funds. No wonder that Japan and China, now limitrophe countries, felt inclined to emancipate themselves from certain privileges formerly granted to the company which limited their free action as to the exchange of their telegraphic traffic. As foreseen long ago, the decrease of the traffic made itself very seriously felt at the return of more normal conditions in the countries connected by the company's cables. It was the enormous Press and Government correspondence in particular which had decreased, without being compensated for by a corresponding increase of the private and commercial traffic; at the same time the two new competing lines in the Far East, the Commercial Pacific Cable Co. and the German-Dutch Co., had commenced to take their share of the traffic. Compared with the previous year, the revenue account showed a decrease in traffic receipts of £97,342. As to expenses, salaries and wages had increased by £5,802, and they must be prepared for a further rise in connection with this item; new stations had been established at Thorshavn, Seydisfjord and Irkutsk, and it had become necessary to increase the salaries of the staff in China and Japan, where the increased cost of living, occasioned by the war, seemed to have become permanent. To the dividend equalisation fund had been added only the ordinary interest of its capital and the small sum of £22,222, although it was to be foreseen that the company would have to draw heavily on the fund in order to avoid a too sudden reduction of the bonus in the future. In this connection it should not be overlooked that a dividend of only 1 per cent. represented £15,000, and that the bonuses of the last few years had been altogether exceptional.

Midland Electric Corporation for Power Distribution, Ltd.

The directors in their report for the year ended December 31st, 1906, state that the improvement noticed in the report for the previous year continues. The gross revenue has increased from £13,646 to £20,388, and the debit to the net revenue account has been reduced from £14,632 to £11,392. During the year under review, the two turbo-generator sets referred to in the last report have been installed at the generating station, and are now working satisfactorily. An additional sub-station at Darlaston has been built and fully equipped, whilst another at Willenhall is in course of erection. Since the commencement of the present year, Mr. Thomas Parker and Mr. Crosland Taylor have felt compelled (owing to pressure of private business) to resign their positions as directors, and Mr. G. H. Nisbett, a gentleman of considerable electrical experience, has been elected a director. Mr. Nisbett's election will be submitted to the meeting for confirmation. Messrs. Chalmers, Wade & Co. offer themselves for re-election as auditors.

The generation of electricity cost £8,754, and distribution £2,253. Sales of energy produced £20,040, and meter and other rents £348, so that there is a balance of £9,381 carried to net revenue. From this have to be deducted management expenses, £4,940; rent, rates and taxes, £1,117; debenture interest requires £11,250, and for premium for guarantee of debentures, £2,500; other interest £694, and sundry other small items, the net result of all this being a debit balance of £11,392 for the year. This increases the balance at debit to £60,946. The auditors in their certificate state that no depreciation has been written off machinery and plant.

A note in the general balance-sheet shows that the liability to contractors for the new turbo-generator sets not certified by the engineer is not included in the accounts.

The National Electric Construction Co., Ltd.

The meeting of this company was held on Monday at Winchester House, Mr. L. B. Schlesinger presiding.

The Chairman in moving the adoption of the report (see Electrical Review, May 3rd, page 737), reminded the shareholders that when they last met he told them that the company had plenty of remunerative work in hand, which he hoped would enable them to show better results for 1906 than for the previous year. The profits made had realised his expectations, and had once more shown a substantial increase; the gross profits amounted to £41,714, as compared with £32,356, while the net profits totalled £30,034, as against £23,585 in the preceding year, an increase of £6,500—a very gratifying result. The undertakings in which the company were financially interested had made satisfactory progress. The Musselburgh undertaking had made a profit in spite of the bad weather in Scotland last year—sufficient to pay the debenture interest and the dividend on the preference shares, with a substantial amount to reserve, although the earning power of the electric lighting scheme had not yet been fully developed. They had expected to make a start on the extension of the line to Port

Seton, but the matter had been delayed owing to the Musselburgh company not seeing their way to accepting the condition of the Musselburgh Corporation for the laying down of a small piece of line about half a mile in length. An inquiry had, however, been held, and the Committee of the House of Commons last Monday passed the order on fair terms, in spite of the Musselburgh Corporation's objections. The extension would be completed as soon as possible, and he had been advised that when completed the line would earn sufficient profits to pay a substantial dividend on the ordinary shares. They had over 20,000 ordinary shares of £1 each in that company, which were not valued in the investments, so that if their expectations were realised they would receive a further income from that source. Portions of the Torquay, Mexborough, and Rawmarsh tramways were now opened, and the traffic receipts were satisfactory, and the results went to show that the company had valuable property in the shares held in those tramway companies. The company was also making satisfactory progress with the Rhondda Tramways, and they hoped to have the work completed before the end of the year. They had arranged to get their current from the South Wales Power Co., and terms had practically been arranged, but the company was not now in a position to give them the supply, owing to its financial troubles, and the company would, therefore, have to build a power station of its own. The capital of the company would have to be increased in order to do that, but from a profit-earning point of view, the undertaking would not be prejudiced in any way thereby; as a matter of fact, their consulting engineer had told them that the saving in the price of current would compensate them for the extra capital expenditure incurred. They had secured concessions for tramways in West Yorkshire, Folkestone, Sandgate and Hythe, and the City of Oxford. In the case of West Yorkshire, Folkestone, Sandgate and Hythe, they had obtained Parliamentary powers, notwithstanding considerable opposition. The Oxford Tramway Bill had already been passed by the House of Lords' Committee, and they did not think there would be any difficulty when they appeared before a Committee of the House of Commons. The company considered that in those schemes they had three of the best tramway undertakings in England, and under favourable conditions there ought to be no difficulty in finding the capital for them. The Dolter system of electric traction had been laid down in the case of Mexborough, Torquay and Hastings, and should it prove satisfactory, it would be used at Folkestone and Hastings, where the overhead system was not permitted. They had procured an extension of five years with the Dolter Electric Traction Co., Ltd., under which their company were to be the sole contractors for laying their surface-contact system for a certain period, and he trusted that the contract would be the means of bringing good and profitable business to the company for the next seven or eight years. They had secured a contract for a tramway between Dewsbury and Osset, in Yorks, but the capital was being provided by the local authority. The company were going to manage the trams for a period of 42 years, taking all the profits, and in return they were to guarantee the interest and sinking fund, and to repay the capital during that period. He believed that the line would be a profitable undertaking. The interests the company had taken in construction syndicates had taken up a considerable portion of their capital for the time being, but when the undertakings had been at work for a year or so, there ought to be no difficulty in realising all or part of their holdings. Over and above the profits on the construction of the lines, the construction syndicates should bring them in substantial profits. The syndicates were formed for the purpose of advancing money necessary to construct the lines, and in return the company got debentures, preference and ordinary shares in the companies so formed; and it was expected that the securities so received would be considerably in excess of the capital of the Construction Syndicates, thus bringing a substantial profit to the shareholders. The company had decided to issue £75,000 5 per cent. debentures, and they would be secured by a specific charge on the investments of the company of a certified value of not less than £100,000, which would be transferred to trustees. A sinking fund policy was to be taken out with a first-class insurance company to provide for the redemption of the debentures at maturity. The sinking fund would cost about £1,500 per annum, and would be a reserve which could not be used in the business of the company. Provision would be made to pay off the debentures at 105 per cent. before the maturity, should the company realise their securities, and not be able to find other remunerative schemes to put their money in. In conclusion, the chairman paid a warm tribute to all the members of the staff, and remarked that thanks were due to them for the excellent work done by them during the past year.

Mr. J. Carr-Saunders seconded the motion, and the report was adopted.

Western Telegraph Co., Ltd.—The directors' report for the half-year ended December 31st, 1906, states that the revenue amounted to £340,687 and the working expenses to £128,095. After providing £16,000 for debenture stock interest, and £3,416 for income-tax, there remains a balance of £193,177; to which is added the sum of £2,663 brought forward from June 30th last, making a total of £195,840. First and second interim dividends, amounting to £62,379, have been paid, and after transferring £100,000 to the general reserve fund, £5,000 to the maintenance ships' reserve fund, £10,000 to the marine insurance fund, and £10,000 to the land and buildings depreciation fund, there remains a balance of £8,461, which is carried forward.

West African Telegraph Co., Ltd.—The directors' report for the year ended December 31st, 1906, states that the revenue amounted to £66,158, from which is deducted £15,506 for the ordinary expenses, and £9,224 for expenditure relating to maintenance of cables, leaving a balance of £41,428, to which is added £1,511 brought forward from the preceding year, making a total available balance of £42,939. The £1,540 has been provided for income-tax, £30,000 has been transferred to general reserve fund, and an interim dividend of 2 per cent. (free of income-tax), absorbing £4,622, was paid on December 1st last. The directors recommend the payment of a final dividend of 2 per cent. (free of income-tax), making, with the interim distribution, 4 per cent. for the year, the balance of £2,155 being carried forward.

Willans & Robinson, Ltd.—At an extraordinary general meeting held last Friday, at Cannon Street Hotel, the resolutions passed at the previous meeting for reducing the capital, were confirmed.

France.—The balance-sheet of La Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston for the last financial year shows a profit of £103,168, out of which a dividend of 27½ fr. per share, which will absorb £88,000, is being declared.

Belgium.—The balance-sheet of the Antwerp Telephone and Electrical Works, of Berchem, Antwerp, for the last financial year shows a loss of £34,114.

West Coast of America Telegraph Co., Ltd.—The report for 1906 states that the gross receipts amounted to £68,048, as against £50,808 in 1905. The working expenses were £34,173, as compared with £31,114. After providing £6,000 for the interest on the 4 per cent. debentures and £800 for the interest on the 4 per cent. income bonds, there remains £27,074, plus £1,661 brought forward. Of this amount £22,000 has been placed to the general reserve fund and £2,000 to the maintenance ship's reserve fund, and the directors recommend a dividend of 2½ per cent., leaving £1,922 to be carried forward.

Ascot District Gas and Electricity Co.—At an extraordinary general meeting held at 50, Cannon Street, E.C., last week, the directors were authorised to raise additional capital by the issue of £8,000 4 per cent. perpetual debenture stock and 1,000 7 per cent. ordinary shares of £10 each, for the supply of electricity in the company's area of supply. Since the last meeting of shareholders the directors had obtained tenders for all the plant and mains necessary. These tenders, which they proposed to accept as soon as the capital was issued, amounted to £14,589. The board did not propose to lay mains in the whole of the compulsory area at first, but to confine the operations of the company to Sunninghill and Sunningdale, where there was likely to be the most immediate demand.

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

Birmingham and Midland Tramways, Ltd.—Further issue of £152,237 4½ per cent. first debenture stock.

Edmundson's Electricity Corporation, Ltd.—The board have issued a circular to the shareholders, in which they state that the results of the company's operations for the past year not having reached their expectations, in view of the prospective financial requirements of the company, they consider it more prudent not to pay the dividend on the preference shares due on May 1st. The board say that they much regret to have to take this course, but they are satisfied that in the circumstances this decision is in the best interests of both classes of shareholders.

Official Announcements re Companies.—The following companies have been struck off the register:—

Electric Battery Case and Fittings Syndicate, Ltd.
Electric Dänite Syndicate, Ltd.
Electric Lamp Renovating Co., Ltd.
Electric Vehicle Co. of Great Britain, Ltd.
Freshwater and Totland (I.W.) Electricity Supply Co., Ltd.
Monte Video New Tramway Co., Ltd.
Northern Engineering Co., Ltd.
R. Cundall & Sons (1905), Ltd.
Torquay Electro-Therapeutic Institute, Ltd.
Tramway Traction Co. of South America.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The report for the half-year ended December, 1906, states that the gross receipts were £296,393, against £317,100 for the corresponding half-year of 1905. The working expenses, including £12,854 for maintenance of cables, absorb £139,649, against £135,597 for the corresponding period of 1905, leaving a balance of £156,844. The net profit for the half-year was £138,385. After adding £88,958 brought forward, there is an available balance of £227,344. One quarterly interim dividend of 1¼ per cent. has been paid for the half-year, and it is proposed to distribute another of like amount on the 16th inst., making a total dividend of 5 per cent. It is also proposed to pay a bonus of 4s. per share, or 2 per cent., making a total distribution of 7 per cent. for the year; £75,000 has been transferred to the general reserve fund, and £17,344 carried forward. The company's New Zealand and China cables have been partially renewed during the year, and the cost (£44,160) has been charged against the general reserve fund. With a view to further improving telegraphic communication with the Far East, the directors have obtained a concession from the Dutch Government for the laying and working of a submarine cable between Java and the Cocos Islands. The communication is expected to be opened towards the end of the current year, and will provide an alternative route for the company's traffic.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	May 1	2,408	— 77	48	65,980	+ 1,756	14·4	..
†Ayr	Apr. 27	213	— 63	20	14,085	— 85	8	..
Bath	May 1	1,417	+ 84	18	12,509	— 62	13	..
Belfast	,, 3	6,958	+ 892	5	17,009	+ 361	40	6½
Birkenhead	,, 5	2,011	— 33	5	5,001	— 394	13·52	..
Birmingham Corp.	Apr. 27	10,884	..	4	22,042	..	28·25	..
Blackburn	May 1	1,932	+ 218	5½	6,125	+ 488	14½	..
Blackpool Corp. ..	,, 2	934	— 5	4½	3,166	— 862	11·87	..
,, —Fleetw'd.	,, 4	676	+ 87	17	5,220	+ 311	8·25	..
Bolton	,, 5	4,279	+ 520	5	10,568	— 317	26	1
Bournemouth ..	,, 1	3,100	+ 151	4½	7,581	— 134	21·5	2·75
†Bradford	Apr. 27	4,310	+ 357	4	18,063	— 91	53	..
Brighton	May 5	1,572	— 36	5	4,164	— 457	9·5	..
Bristol	,, 4	9,417	+ 207	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	Apr. 25	437	— 3	16	3,585	— 7	3·65	..
Barnsley	,, 25	306	— 63	,,	2,573	— 70	..	..
Barrow	,, 25	431	— 69	,,	3,577	— 13	5·37	..
Cavehill	,, 25	132	— 234	,,	1,146	+ 25	..	..
Devonport ..	,, 25	850	— 84	,,	7,111	+ 108	8·85	..
Gateshead ..	,, 25	1,887	— 59	,,	15,855	+ 487	11·25	..
Gravesend ..	,, 25	445	— 104	,,	3,586	+ 104	6·5	..
Greenock	,, 25	1,271	— 53	,,	9,962	+ 63	7·25	..
Hartlepool ..	,, 25	513	— 88	,,	4,107	— 252	6·72	..
Kidderminster ..	,, 25	184	— 113	,,	1,560	— 73	..	..
Leamington ..	,, 25	257	— 148	,,	2,261	— 116	3	..
Merthyr	,, 25	372	— 91	,,	3,269	+ 191	2·9	..
‡Metropolitan ..	,, 25	8,106	+ 227	,,	64,948	+14,632	22	..
Middleton	,, 25	601	— 284	,,	5,185	+ 59	8·5	..
Mid. Joint Com'tee	,, 25	10,433	..	,,	89,027	..	..	..
Oldham — Ashton	,, 25	1,114	— 160	,,	9,454	+ 611	9·13	..
Peterborough ..	,, 25	205	— 100	,,	1,788	+ 10	5·31	..
Potteries	,, 25	3,626	— 111	,,	29,591	+ 256	29	..
Rothesay	,, 25	229	— 172	,,	1,383	+ 40	2·75	..
Southport	,, 25	476	— 303	,,	3,851	— 387	8·17	..
S. Metropolitan ..	,, 25	1,862	..	,,	11,364	..	..	..
Swansea	,, 25	1,565	— 264	,,	13,015	+ 329	6·5	..
Tynemouth	,, 25	333	— 232	,,	2,722	— 329	3·75	..
Weston-s-Mare ..	,, 23	118	— 172	,,	714	— 28	3	..
‡Worcester	,, 25	487	— 146	,,	3,981	— 101	5·75	..
Wrexham	,, 25	202	— 1	,,	1,568	— 24	..	..
Yorks. Wool. Dist.	,, 25	1,804	— 255	,,	4,946	+ 941	17	..
Miscellaneous ..	,, 25	412	— 59	,,	3,242	— 71	..	..
Burnley	May 4	2,318	+ 94	..	..	..	7·5	..
Burton-on-Trent ..	,, 5	530	— 37	5	1,362	— 166	10	1·5
Bury	Apr. 28	1,830	..	4	3,807	..	10·5	..
Cardiff	,, 27	3,778	— 315	4	7,992	— 93	15·87	..
Carlisle	May 4	332	— 10	18	2,700	— 242	..	..
Chatham and Dist.	,, 2	1,288	+ 154	18	11,399	+ 848	12·84	3·51
Cork	,, 2	856	+ 55	18	7,515	— 142	9·89	..
Croydon	,, 3	2,688	+ 34	5	6,556	— 534	12	·75
Darlington	,, 4	399	+ 11	5	1,017	— 1	..	..
†Darwen	Apr. 26	244	+ 17	4	885	— 122	4·36	..
†Dover	,, 27	191	+ 4	4	852	— 105	4·75	..
Dublin	May 3	10,488	+ 761	18	84,461	+ 2,846	54·25	5·75
Dundee	,, 1	2,099	+ 144	48	54,686	+ 7,286	13	·5
East Ham	,, 4	1,693	+ 59	5	4,343	— 225	8	..
Exeter	,, 3	590	+ 107	5	1,483	+ 117	4·75	·5
Glasgow	,, 4	35,350	+4,337	48	818,108	+65,937	88·25	8·75
Hastings	,, 3	1,715	..	..	..	..	..	..
Huddersfield ..	,, 4	2,889	+ 247	5	7,750	+ 422	28	..
Hull	,, 4	4,610	+ 461	5	11,409	+ 356	13	..
Ilford	,, 4	873	+ 4	5	2,360	— 177	6·87	..
Ilkeston	,, 1	288	+ 29	5	679	+ 90	3·5	..
Ipswich	,, 4	692	+ 1	5	1,818	— 143	10·5	..
Isle of Thanet ..	,, 4	697	— 54	18	5,261	+ 11	11	..
Kilmarnock	,, 4	288	+ 6	51	7,984	+ 148	4·25	..
Lan'kshire Trm. Co.	,, 2	2,856	+ 551	18	18,628	+ 3,645	15·82	3·26
Lancashire United	,, 1	2,205	+ 725	18	19,961	+ 5,438	38·5	10·5
Leeds	Apr. 27	12,100	— 756	4	25,096	+ 1,504	96	6·5
Leicester	May 4	4,161	+ 77	..	..	..	..	..
Leith	Apr. 27	948	+ 22	50	25,181	+ 6,309	6	..
Liverpool	,, 27	20,771	— 812	17	176,263	+ 2,283	104	..
‡L.C.C.	,, 20	56,979	+ 226	3	86,446	+ 6,382	113·5	14·1
London United ..	May 3	11,291	+ 308	18	96,972	+ 2,644	..	..
Lowestoft	,, 4	273	+ 43	31	4,723	+ 610	..	..
Manchester	,, 4	27,285	+3,061	5	68,046	+ 5,501	159	13
Newcastle	,, 4	7,929	+ 571	5	19,979	+ 170	..	..
Newport	,, 4	1,207	+ 115	5	3,207	+ 140	14·5	..
Northampton ..	,, 3	767	+ 18	5	1,966	— 63	5·5	..
Oldham	,, 5	3,674	+ 513	6	11,650	+ 1,304	28·75	..
Pontypridd	,, 4	474	+ 186	5	1,367	+ 462	5	1·75
Portsmouth	,, 4	3,439	+ 319	5	9,133	— 224	14·5	..
Preston	,, 1	1,340	+ 80	..	..	..	..	..
Reading	,, 2	966	— 126	..	2,563	— 286	7·25	..
Rochdale	Feb. 19	958	+ 152	..	..	..	20·6	..
Rotherham	May 2	1,101	+ 256	4½	2,633	+ 341	10	·67
Salford	Apr. 29	8,594	+ 580	4	18,555	— 190	38·9	..
Sheffield	May 5	10,399	+1,179	6	32,284	+ 1,620	35·75	..
Southampton ..	,, 1	1,763	+ 102	4½	4,154	+ 43	..	..
Southend-on-Sea ..	,, 1	566	— 15	5	1,416	— 189	..	..
Sunderland	,, 5	2,664	+ 246	5	6,675	— 78	..	..
Swindon	,, 1	295	— 29	..	..	..	4·4	..
Tyneside	,, 1	814	+ 120	18	7,196	+ 610	8·87	..
Walthamstow ..	,, 4	971	+ 54	5	2,681	— 209	9	..
West Ham	,, 2	4,322	+ 356	5	11,885	+ 530	14·7	..
Wolverhampton ..	,, 2	1,550	+ 84	4	3,729	+ 52	20	..
Yorks. W. Riding ..	,, 5	2,282	+ 748	18	19,281	..	..	..
Baker St.-Waterloo	,, 4	4,970	+2,152	8	18,585	+ 5,696	4	·75
Cen. London Rly.	,, 4	11,940	—1,542	16	111,540	—11,281	6	..
City & S. Lon. Rly.	,, 5	5,790	+ 278	18	53,147	+ 857	6·25	..
Dublin-Lucan Rly.	,, 3	211	+ 11	18	1,736	— 17	7	..
G.N. and City Rly.	,, 4	3,617	+ 71	18	33,185	+ 53	3·5	..
G.N., P'dy. & Brmp.	,, 4	8,180	+ 125	18	64,384	..	9	..
L'pool Overh'd Rly.	,, 5	2,990	+ 236	18	25,248	+ 160	6·8	..
Mersey Railway ..	,, 4	3,570	+ 228	18	32,947	+ 1,417	4·5	..
Metropolitan Rly.	,, 5	30,824	— 92	18	271,412	—25,282	24·5	..
Met. District Rly.	,, 5	15,573	— 132	18	140,998	— 2,572	24	..
†Anglo-Argentine ..	Apr. 29	17,006	+2,107	17	278,230	+23,640	43	..
§Auckland	Mar. 29	9,846	+1,332	13	32,152	+ 860	19·24	·6
§Brisbane	,,	13,199	+1,688	..	..	..	..	..
§Brit. Columbia Rly.	Mar.	24,800	+6,630	69	224,000	+42,500	..	..
Bu'n's A'r's E.T Co.	Mar. 2	3,247	+ 290	9	14,647	+ 1,869	..	..
†Bu'n's A'r's-Blgr'no	Apr. 21	3,911	+ 314	16	60,238	+ 4,091	..	..
Calcutta	May 4	6,075	+ 370	..	..	..	..	..
§Cape Electric T.Ld.	Mar.	14,549	..	..	..	..	..	..
§Geneva	Mar.	7,031	+ 546	..	..	..	..	..
§Kalgoorlie, W.A...	Mar.	4,420	..	13	11,718	..	20·5	..
Madras	Apr. 30	1,154	+ 293	17	9,193	+ 1,980	12·75	3·5
§Lisbon	Mar.	28,000	..	..	..	..	..	..
Perth (W.A.) ..	May 3	2,814	— 137	18	26,967	— 366	25·6	·4

* Compared with the corresponding period of 1906. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

Optimism favours the impression that the Bank Rate will again be reduced before long, and, on this, some of the investment markets are harder. It is known, however, that heavy loans are still required by highest-class borrowers; while, as for business, there is certainly not sufficient to go round the 5,000 members of the Stock Exchange.

Edmundson's Electricity Corporation provided the surprise of the week, shareholders being astonished to receive an intimation last Friday that the Preference dividend, due two days earlier, would not be paid. The board say that "the results of the company's operations not having reached their expectations, and in view of the prospective financial requirements of the company, they consider it more prudent not to pay the dividend."

If the Edmundson's shareholders are content to sit down passively with folded hands instead of demanding a clear statement of the company's position, financial and commercial, they will deserve small sympathy. The Edmundson's at one time, and that not so very long ago, was regarded as one of the front-rank undertakings, and allowing for all the troubles that have fallen upon electricity concerns of late, the passing of the preference dividend would seem to indicate that the management might be better for a little overhauling.

We believe that the delay in the announcing of this non-payment was due to the difficulty experienced by the board in deciding whether to make the distribution or not, and that the question was really settled by a few of the largest shareholders summoned by the directors to consult on the point.

Edmundson's Preference are 2⅝ offered, and Urban Ordinary dropped to 2. In the latter movement some read the result of the company's recent issue of 4½ per cent. Debenture stock at 94. Bromptons are harder, but the list as a whole is very colourless.

Publication of the particulars of the L.C.C. Electricity Bill has not affected the market one way or the other. Its whole effect was discounted, and the clauses are regarded with nonchalance. In fact, the electric lighting market has sunk into so deep a rut of gloom that prices seem to be incapable of material movement, except in the direction of falling.

Telegraph securities are fairly firm, and there is more business doing in them of a general character than usual. The dwindling of the price of Eastern Extension shares is to some extent explained by the report, showing receipts to have been £24,700 less than in the corresponding half-year. This, however, does not make much difference to the proprietors, for the dividend and bonus are brought up to the regular 7 per cent., and £75,000, of which £25,000 is extra this year, is put to the general reserve fund. The price of the shares remains about 13½, so that the yield on the money comes to a trifle over 5 per cent. Eastern Telegraph Ordinary returns slightly less. Alteration in the date of making up the books of the Eastern Telegraph Co. has lately been made, but the 7 per cent. dividend goes on like Tennyson's brook. On West African Telegraphs a 4s. dividend is declared and on West India and Panama First Preference, a dividend of 8s., neither of these causing any change in prices. West Coast of America, Great Northern and Indo-Europeans have improved. Submarine Cables Trust rose by 128½ upon the good report. Globes are also better.

Traction descriptions are dull as regards British Electrics, the Ordinary shares being down to 50s. British Westinghouse Debenture fell a point to 66. Anglo-Argentine Trams experienced an upward reaction after sagging away for some time, and other issues in this department are very steady. Buenos Ayres and Belgranos rose to 3⅜, upon the meeting to-day, Tuesday. Calcutta Trams at 7⅞ were slightly lower.

There is a rather better tone amongst some of the manufacturing shares. Dick, Kerr Ordinary rose ⅛, the Preference ⅛, and the Debenture stock a point. Telegraph Construction rose to 31; and Henleys were dull at 12¼. No other quotable changes occurred, but the market is by no means a bad one.

Electrical railway stocks are dull, and Central Londons have begun to lose part of their recent firmness. The Deferred stock crumbled to 47½ and the Ordinary to 76, the traffic decrease having passed the £11,000 mark for the 18 weeks of the half-year to date. Metropolitan Consolidated is 47, and at 14 Districts show no change.

Submarine Cables Trust.—The report for the past year states that the revenue for the period amounted to £25,277, and the expenses to £1,162, leaving a balance of £24,115. After providing £18,627 to meet payment of the coupons, £5,149 has been transferred to the redemption fund, leaving £153 to be carried forward.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations April 30th.	Closing Quotations May 7th.	Business done week ended May 7th, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,320 Red.	100	Nil	Nil	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11
660,660	Anglo-American Telegraph	Stock	61s.	22½%	31½%	31½%	61 — 64	61¼ — 64¼	..	..	+ ½	6 0 2
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5½%	6 %	6 %	106½–107½	106½–107½	107⅞	107	..	5 11 4
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	1½%	12½%	22⅛ — 22⅞	20⅞ — 21⅛	21⅛	21	—1½	8 4 8
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	..	99 —101	99 —101	100	..	..	4 19 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6¾ — 7¼	6¾ — 7¼	7⅞	..	..	5 10 4
2,097,680	Commercial Cable Stng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	93 — 95 xd	93 — 95	94½	93½	..	4 4 3
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	8 — 8½	8 — 8¼xd	..	..	..	5 17 8
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	16 — 17	16 — 17 xd	16½	..	..	5 17 8
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8⅜ — 8⅝ xd	8⅜ — 8⅝	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8⅞ — 9¼ xd	8¾ — 9¼	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,710	Direct United States Cable	20	8 %	8½%	4½%	..	15⅛ — 15⅝	15⅛ — 16	15⅞	15½	+ ⅜	5 6 3
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	100 —102	..	..	+1	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	137 —142	139 —144	142	138½	+2	4 17 3
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	88½ — 90½	89 — 91	90½	90	+ ½	3 16 11
1,696,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	104½–106⅛ xd	104½–106⅛	105	104½	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	13¼ — 13⅜	13¼ — 13⅜	13⅛	13⅛	..	5 1 10
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105 —107	105 —107	106½	104½	..	3 14 9
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	98 —101	98 —101	98	..	..	3 19 3
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	98 —100 xd	..	..	..	4 0 0
181,127	Globe Telegraph and Trust	10	5½%	5⅝%	5½%	..	10¾ — 11	10⅝ — 11⅛	10⅞	10⅞	+ ⅛	4 18 10
181,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	..	13⅜ — 14½	12⅞ — 14⅜	14½	13⅝	+ ⅛	4 3 6
150,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	24 %	24%	20 %	85 — 87	86 — 87	35	33½	..	5 6 8
83,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	100 —102	..	..	+1	4 8 3
17,000	Indo-European Telegraph	25	10 %	18 %	18 %	13 %	58½ — 60½	59 — 61	..	..	+ ½	5 6 7
266,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	8 %	4 %	5 %	..	1 3/16 — 1 7/16	1 3/16 — 1 7/16	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	¾ — 1	¾ — 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108 — 110	108 —110	109½	108½	..	5 9 1
2,225,000	Do. do. Def. Stock	100	5 %	5 %	5 %	5½%	104½–106½	104½–106½	105½	104½	..	5 3 4
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11½ — 12½	11½ — 13½	12½	..	..	4 8 11
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅝ — 5⅞	5⅝ — 5⅞	5⅞	5⅝	..	4 9 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96 — 98	96½ — 97⅜	96	95½	— ⅛	3 14 10
1,689,598	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101½	100½	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6¼%	6¼%	7½%	7 %	1⅝ — 1⅞	1⅝ — 1⅞	28/1½	..	..	5 4 4
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1⅛ — 1¼	1⅛ — 1¼	..	..	..	4 16 0
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
11,889	Reuter's	8	5 %	5 %	5 %	..	7½ — 8½	7½ — 8½	8¼	..	+ ¼	4 14 1
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
8,167	Submarine Cables Trust	Certs	6 %	6 %	6 %	6 %	125 —128	125 —128 xd	128/1½	..	..	4 13 9
80,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6¾ — 7½	6¾ — 7½	7⅜	6⅛	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5 — 5½	5 — 5½	..	..	..	4 15 3
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	109 —112	109 —112	..	..	..	4 9 3
15,609	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10½	10 — 10½	..	..	..	3 16 2
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2	Nil	Nil	Nil	..	⅝ — ¾	1 — 1¼	18/9	13/1½	+7/16	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 — 102	99½	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13⅜ — 14⅛	13⅜ — 14⅛	13 11/16	13⅜	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —105	102 —105	..	..	..	3 16 2
88,891	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	0 — 1/16	0 — 1/16	13/1½	11/9	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	7 %*	6 %	5 %	8 %	7⅞ — 8¼	8 — 8½	8¼	..	+ ¼	9 8 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6½ — 7¼	6¼ — 7½	6¾	..	+ ¼	Nil
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17 1

* Including arrears.

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007		..	8 %	8 %	8 %	7½ — 7⅞	7 7/16 — 7 13/16	7 13/16	7 13/16	+ 1/16	5 2 5
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5 3/16	5 3/16	5½%	5½%	5⅜ — 6	6 — 6⅛	5 13/16	5 13/16	..	4 11 8
266,800	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	182 — 185	183 —186	184½	..	+1	4 8 3
215,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	105½	..	..	4 13 6
89,000	Babcock & Wilcox, 1 to 580,000	1	17 %	40 %	20 %	10 %	3⅞ — 4	3⅞ — 4	80/-	77/6	..	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8 xd	1 1/16 — 1 1/8	..	..	..	5 15 7
88,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	..	5¼ — 5⅜	5¼ — 5⅜	..	..	..	6 1 9
40,000	Do. do. 7 % Cum. Pref...	5	Nil	7 %	7 %	..	5¼ — 6¼	5¼ — 6⅜	..	..	..	5 12 0
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	5¼ — 5¾	5¼ — 5¾	..	..	..	5 4 4
40,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	..	4 — 4¼	4 — 4¼	..	..	..	4 8 11
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	101 —105	101 —105	..	..	..	4 15 8
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	98 —101	98 —101	..	..	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	6 %	123 —127 xd	123 —127	..	..	..	4 14 6
500,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	106 —111	106 —111	109	..	..	4 10 1
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	102 —106	102 —106	..	..	..	4 14 4
238,000	Do. 4½ % 1st Mort. Debs., 1 to 5,250	40	4½%	4½%	4½%	4½%	99 —101	99 —102	1 0/4	..	+ ½	4 8 3
450,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102¼–104½	102¼–104½	103½	..	..	4 9 1
188,201	British Electric Traction	10	6 %	6 %	8 %	..	2½ — 3	2½ — 2⅝	55/-	45/-	— ¼	10 18 2
1,161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	6¼ — 7	6½ — 6⅝	6 13/16	6¼	— ¼	8 17 9
1,448,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	101 —105	100—104	100⅛	100	—1	4 16 2
210,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	..	79 — 82 xd	79 — 82 xd	..	..	..	5 9 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6¾ — 7	6¾ — 7	6 23/32	6¼	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5¾ — 6¼	5¾ — 6¼	6⅛	5⅝	..	4 16 0
600,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	94 — 98	92 — 96	..	..	..	4 11 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1⅛	1 — 1⅛	25/-	23/9	..	Nil
1 016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	65 — 69	64 — 68	67	64½	—1	5 17 8
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	13/6 to 15/6	13/6 to 15/6	..	..	..	Nil
50,000	¶ Do. do. 6 % Cum. Pref. ..	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	20%	..	⅞ — 1	⅞ — 1	..	..	..	5 14 3
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1½ — 1⅝	1½ — 1⅝	..	..	..	6 17 2
125,000	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	89 — 92	89 — 92	..	..	..	4 17 10
125,000	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	75 — 78	75 — 78	..	..	..	5 15 5
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	3 %	4 %	3 %	3 %	3⅜ — 3¾	3¼ — 4	73/9	70/-	+ ⅛	3 15 0
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	5 — 6⅛	5 — 5⅞	5 3/16	5 3/32	..	5 14 3
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅝ — 5⅜	4⅝ — 5⅜	..	..	..	5 12 11
13,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
190,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 —104	101 —104	102½	..	..	4 16 2
137,610	Calcutta Trams., 1 to 137,610	5	6 %	8 %	8 %	8 %	7⅞ — 8¼	7⅞ — 8 xd	8 1/16	7⅞	..	5 0 0
50,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	..	5 %	5 %	5¼ — 5⅝	5¼ — 5⅝	..	..	..	4 6 11
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
85,000	Callender's Cable Construction shares	5	12½%	12½%	15%	..	10½ — 11½	10 — 11	10⅝	10¼	— ⅛	6 16 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¾ — 6¼	5¾ — 6¼	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Red.	Stock	4½%	4½%	4½%	4½%	106 —108	106⅛—108⅛	..	..	+ ⅛	4 2 11
491,222	Cape E. Trams., 1 to 491,222	1	10 %	5 %	Nil	..	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	4 11 5
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102	..	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	75 — 77	74 — 76	76	75½	—1	5 6 3
544,216	Do. do. 4 % Pref. Stock ..	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	93½	..	..	4 5 1
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	57 — 60	55 — 58	56½	56	—2	6 17 11
1,450,000	City and South London Railway	Stock	2½%	2½%	1½%	2½%	41 — 43	41 — 43	42⅝	42	..	4 18 10
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	2½%	2½%	..	1⅝ — 2⅜	1⅝ — 2⅛	..	..	..	3 10 2
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	97½	96	..	5 1 0

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued.)*

Present Issue.	NAME.	Stock or share.	Dividends for the last four years.				Closing Quotations April 30th.	Closing Quotations May 7th.	Business done week ended May 7th, 1907.		Rise + or Fall —	Present Yield per cent.
		†	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1¼ – 1⅜	1 5/32 – 1 3/32	..	..	— 5/32	7 15 4
305,000	Do. do. 5 % Cum. Pref., 1 to 305,000 ..	1	5 %	5 %	5 %	..	1 3/32 – 1 5/32	1⅛ – 1¼	..	..	+ 3/32	4 16 0
294,150	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	101 –104	102 –105	101½	..	—1	4 5 9
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5½ %	6 %	6 %	..	14½– 15½	14½– 15½	..	..	..	3 18 8
59,987	Do. 6% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13½ – 14½	13½ – 14½	..	..	..	4 2 9
99,261	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,261	5	Nil	1¼ %	1¾ %	..	1⅛ – 1⅜	1⅛ – 1⅜	..	..	..	9 3 9
17,189	Do. "A" shares, 01—017,189	5	Nil	2½ %	4½ %	..	2¼ – 2½	2¼ – 2½	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 – 87	85 – 87	..	..	..	4 12 0
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	88 – 92	89 – 92	..	..	..	5 8 8
114,100	Electric Construction 1 to 112,100	2	4 %	Nil	Nil	..	5/16 – 7/16	½ – ⅝	..	..	—1/32	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	..	1⅞ – 2	1⅞ – 2	..	..	..	7 0 0
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	81 – 84	81 – 84	..	..	..	4 15 8
95,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8⅞ – 9⅛	8⅞ – 9⅛	..	..	..	5 2 4
900,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	92 – 95 xd	92 – 95	..	..	..	4 4 3
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	3 %	4 %	4 %	4 %	2½ – 3	2½ – 3	..	..	..	11 0 0
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ – 10⅞	10½ – 10⅞	..	..	..	6 13 4
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 –103	102 –108	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12 – 13	11⅞ – 12⅞	12	..	— ⅛	5 17 8
900,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5⅛ – 5⅜	5⅛ – 5⅜	..	..	..	3 15 7
150,000	Do. do. 4½ Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	107 –109	107 –109	..	..	..	4 2 7
60,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10%	5 %	10%	10 %	15½ – 16½	15½ – 16½	15½	15½	..	6 3 1
87,500	Liverpool Overhead Railway, Ord.	10	12½ %	12½ %	Nil	Nil	1½ – 1⅝	1½ – 1⅝	..	..	..	Nil
10,000	Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	6 – 7	6 – 7	..	..	..	7 8 2
600,070	London United Trams (1901), 1 to 50,007 ..	10	8 %	8 %	8 %	8 %	7 – 8	7 – 8	..	..	..	8 15 6
899,980	Do. do. 50,008 to 100,000	10	8 %	8 %	8 %	8 %	7 – 7½	7 – 7½	..	..	..	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000 ..	10	5 %	5 %	5 %	5 %	7⅞ – 8⅛	7⅞ – 8⅛	..	..	..	5 14 3
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	84 – 87	84 – 87	..	..	..	4 9 11
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	Nil	1/32 – 1/16	1/32 – 1/16	2/3	..	..	Nil
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/32 – 1/8	3/32 – 1/8	17/6	..	..	5 8 11
850,000	Do. 4½ % Deb. Stock Red.	100	..	4½ %	4½ %	4½ %	96 – 99	96 – 99	97⅛	..	..	4 10 11
80,000	Peebles (B.) & Co. 6 % Cum. Pref., 50,001 to 80,000	5	..	6 %	6 %	6 %	4 – 4½ xd	4 – 4½ xd	..	..	..	7 10 0
2 5 500	Potteries E. Tro.	1	5 %	5 %	4 %	4 %	⅜ – ⅝ xd	⅜ – ⅝	..	..	..	6 8 0
145,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜ – ⅝	⅜ – ⅝	..	..	..	6 13 4
345,000	Do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	..	98½–101¼	98½–101½	..	..	..	4 8 8
87,850	Telegraph Construction and Maintenance ..	12	0 %	15 %	15 %	15 %	29½ – 31½	30 – 32	31	30	+ ½	5 12 2
150,000	Do. 4 % Deb. bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100 –103	100½ –101½	1 2	..	— ½	3 18 10
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	..	5 %	5 %	76 – 79	76 – 79	..	..	..	6 6 7
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	1½ – 1⅝	1½ – 1⅝	32/6	..	..	Nil
66,666	Do. 6 % C. P., 80,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3½ – 4½	3½ – 4½	82/6	80/-	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	79 – 83	79 – 83	..	..	..	4 16 5

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5½%	5½%	5½%	4⅜ – 5⅛	4⅜ – 5⅛	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	97 – 99 xd	97 – 99	..	..	..	4 10 11
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 30,000	5	10 %	10 %	10 %	10%	7⅞ – 8⅛	8 – 9	..	..	+ ⅛	5 11 1
10,302	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 – 8	7 – 8	..	..	..	4 7 6
836,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	100 –103	100 –103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply ..	5	8 %	8 %	5 %	5 %	3½ – 4⅛	3½ – 4⅛	78/9	..	..	5 11 1
80,000	Do. do. 4½ % Cum. Pref.	5	4½ %	4½%	4½%	4½%	4 – 4⅛	4 – 4⅛	85/-	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½ %	4½%	4½%	4½%	3⅞ – 4⅛	3⅞ – 4⅛	..	..	..	5 5 11
427,400	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 – 99	96 – 99	..	..	..	4 0 10
49,486	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3¾ – 4⅛	3⅞ – 4⅛	..	..	..	4 14 9
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	104 –107	104 –107	105½	..	..	4 4 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	9⅜ – 10⅛	9½ – 10⅜	10⅝	..	..	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11½ – 12⅛	11½ – 12⅛	11⅞	11½	..	4 18 0
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 –125	123 –126	125	..	+1	3 19 4
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	97 –100	97 –100	97	..	..	4 10 0
40,000	County of Durham Electrical Power, Ord.	5	4 %	£3 7 0	4 %	4 %	4½– 5	4½– 5	..	..	..	4 0 0
60,000	Do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	4½– 5	4½ – 5	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	8 – 8½	8 – 8⅜	..	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ – 11½	10½ – 11½	11	..	..	5 4 4
400,000	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	106 –109	106 –109	..	..	..	4 2 7
400,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	95 – 98 xd	95 – 98	96½	96	..	4 11 10
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	4 %	..	1 – 2	1 – 2	..	..	..	10 0 0
80,000	Do. do. 6 % Cum. Pref...	5	6 %	6 %	6 %	..	2½ – 3½	2 – 3	52/6	37/6	— ½	10 0 0
350,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	87 – 89	87 – 90	..	..	+ ½	5 0 0
10,000	Folkestone, 1 to 10,000	5	5½ %	5½%	5½%	5½%	4⅝ – 5⅜ xd	4⅝ – 5⅜ xd	..	..	..	5 2 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	5 – 5⅛	5 – 5⅛	..	..	..	4 15 8
90,000	Do. 4½ % 1st. Deb. Stock	100	4½%	4½%	4½%	4½%	97 –100	97 –100	..	..	..	4 10 0
18,000	Hove, 1 to 18,000	5	8½%	8½%	9 %	9 %	7 – 7½	7 – 7½ xd	..	..	..	6 0 0
21,000	Kensington and Knightsbridge Electric Ord.	5	12½ %	12½ %	10 %	10 %	8½ – 9½	8½ – 9½	..	..	..	5 0 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 –100	97 –100	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	8	Nil	8 %	4 %	4 %	1⅞ – 2⅛	1⅞ – 2⅛	..	..	..	5 6 8
70,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	6 %	4⅜ – 5⅛	4⅜ – 5⅛	..	..	..	5 14 3
874,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	95 – 98	96 – 98	..	..	..	4 11 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8½%	10 %	10 %	8 %	6 – 7	6 – 7	..	..	..	5 14 4
76,121	Do. 4½ % Cum. Pref. 1—71,106 ..	5	4½%	4½%	4½%	4½%	4⅜ – 5⅛	4⅜ – 5⅛	..	..	..	4 8 9
220,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	106 –110	106 –110	..	..	..	4 1 10
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	90 – 93	89 – 93	..	..	— ½	3 15 3
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 – 98	95 – 98	..	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	7⅛ – 7⅞	7⅛ – 7⅞	..	..	..	5 3 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	5 %	5 – 6	5 – 6	..	..	..	4 3 4
12,852	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	12 – 13	12 – 13	..	..	..	5 15 5
64,000	Do. do. 4 % 1st Mort.Deb... ..	100	4 %	4 %	4 %	4 %	96 – 99	96 – 99	..	..	..	4 0 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6½%	7 %	7 %	7 %	5⅞ – 6⅜	5⅞ – 6⅜	..	..	..	5 9 10
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 – 98	96 – 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	14½%	14½%	12½%	10 %	7½ – 8½	7½ – 8½	8	7⅝	..	5 17 8
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6½ – 7½	6½ – 7½	..	..	..	4 13 4
150,000	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	93 – 95	92 – 95	..	..	— ½	3 13 8
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1½ – 2½	1½ – 2½	..	..	..	Nil
80,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	73 – 77	73 – 77	..	..	..	5 3 11
66,000	South London Electricity Supply, Ord.	5	3 %	4 %	4 %	3 %	2½ – 2⅝	2½ – 2⅝	..	..	..	5 9 1
120,000	South Met. Elec. Lt. & Power, Ord... ..	1	Nil	Nil	2½%	2½%	2⅝ – 3	2⅝ – 2⅞	..	..	..	3 6 8
117,968	Do. Do. 7 % Pref... ..	1	7 %	7 %	7 %	7 %	1⅛ – 1⅜	1⅛ – 1⅜	..	..	..	5 1 10
200,000	Do. Do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 –103	100 –103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	2 – 3	1½ – 2½	..	..	— ½	10 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	3 – 4	3 – 4	..	..	..	6 5 0
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½%	4½%	4½%	95 – 98	95 – 98	..	..	..	4 11 10
110,000	Westminster Electric Supply, Ord.	5	12½%	14 %	13 %	12 %	9 – 10	9 – 10	..	..	..	6 0 0
81,279	Do do. 4½ % Cum. Pref. ..	5	5 %	5 %	5 %	4½%	5½ – 5⅞	5¼ – 5⅝	..	..	..	3 18 3
	(Originally £5 -) 4½ % from 31st Dec., 1905.											

Shares not officially quoted:—Mackay Companies, ord., 70—72 — 1½. Pref. 70—72 — 1½.
Unless otherwise stated all shares are fully paid. ‡ Interim dividends

Bank rate of discount 4 per cent. April 25th, 1907.

PROCEEDINGS OF INSTITUTIONS.

Electric Wave Propagation.

By J. E. Taylor.

(*Paper read before the* Institution of Post Office Electrical Engineers (Metropolitan Centre), *January 11th*, 1907.)

(*Concluded from page 744.*)

Propagation of Guided Waves along Conductors.—The primary function of the conductor in all telegraph and telephone circuits, and, in fact, in all electrical applications, is the guidance of waves from point to point. Where an earth "return" is used, this function is taken part in by the earth's surface, not, however, as a "return" in its literal sense, but as a parallel conductor acting in conjunction with the wire. The subject of wave guidance in such circuits has already been touched upon in the special case of condenser discharges and oscillations. The operations involved in any other case of wave propagation or transmission of impulses of current along a circuit are but a slight variation therefrom.

In long telegraph and telephone circuits one is necessarily concerned with the initial stages of current formation and the nature of the propagation involved, because the operations taking place before the whole of the circuit is called into activity are made use of. In long-distance telephony there may exist, at any moment of time, the electrical prototype of a whole syllable, or at least some appreciable part of a word, involving a great many different current impulses, stored in the circuit during transmission. In submarine telegraphy likewise a number of different signals may also be stored at any particular instant. If one is to learn how these complex impulses are to be most efficiently dealt with and saved from deterioration during the period of time occupied in their transmission from point to point along the circuit, an appreciation of the mechanism of propagation, other than that contained in an involved mathematical equation, appears desirable.

In order to obtain a working physical conception of wave propagation along a circuit, it is highly desirable that a picture of the whole electromagnetic field should be kept in view. In the early stages of current formation in any circuit the current consists of lines of electric strain having a lateral motion in the direction of propagation (fig. 22). In the side view the small white

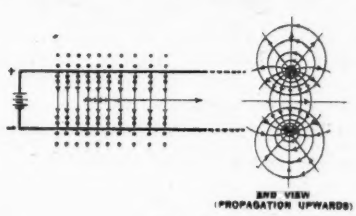


Fig. 22.

circles represent sections across magnetic lines of force having a direction inwards, and the black dots the same lines, but having an outward direction. The strength of the electric current is defined either in terms of the density of the magnetic field under fixed conditions, or in terms of the "quantity of electricity" which flows past a given point in a given time, *i.e.*, the product of the number and velocity of lines of strain which pass. The latter is also the factor which determines the strength of the magnetic field.

The velocity of propagation towards which all impulses of current tend is that imposed by the constants of the ether, viz., the velocity of light. This speed of propagation could only be obtained by guided waves along wires if the wires had perfect conductivity. The presence of resistance allows the capacity of the wires for holding a charge to make itself felt. Opposed to this effect is the tendency of the charge so held to distribute itself along the wires both ways—that is, both backwards and forwards. The tendency to reverse distribution makes itself felt, when telephoning over a line of heavy capacity, as a disagreeable "back-tone" in the receiver when speaking into the microphone. It also holds the impulse back so that its mean velocity of propagation is greatly less than that of a free wave in ether. The wave may then be regarded as of two parts, one which is held, and one which flows over the held part to an uncharged portion of the circuit further on, there again to be held in its turn, and so on.

Opposed to the tendency of a held charge to distribute backwards, fortunately for telephony, there is the inertia property of the circuit, its self-induction which resists a reversal of the direction of propagation, as it also resists its forward propagation.

Its utility, however, primarily lies in its opposition to reversal or even slowing down of the rate of propagation after it has once been established, *i.e.*, its resistance to change of state. It will be sufficient for present purposes to define the self-induction as capacity for taking up a magnetic field (or magnetic induction). Both of these factors, capacity and self-induction or inductance, tend primarily to hold back the impulses, hence they unite in slowing down the rate of propagation—so much so indeed that they are the controlling factors concerned in the velocity of propagation. In a simple circuit the capacity effect always predominates very largely over the inductance, hence the desirability of "loading" the circuit in such a way as to increase its magnetic capacity.

Following the propagation of the impulses to the distant limits of the circuit where they arrive, if the loop is a very long one, in an attenuated and much distorted condition, the effects of reflection will usually be called into operation. Two cases or types of reflection are involved, and that which actually occurs is a compromise between them. These two cases will be considered separately. The first involves the assumption that the two wires of the loop are disconnected at the distant end, while the second involves their being connected directly together or "looped." On arriving at the disconnected end the impulses are arrested and the magnetic field succumbs as a result of the cessation of lateral translation of the lines of strain. Its energy is given up to the electric field, which is therefore correspondingly augmented in the ratio of $1 : \sqrt{2}$ so far as strength of field is concerned, which means $1 : 2$ so far as energy is concerned. The lines of strain so formed now begin to expand laterally backwards in precisely the same way as they originally expanded and travelled forwards, but give rise to a magnetic field of reverse sign, because they have a reverse direction of motion. This constitutes the first type of reflection. But if the circuit be closed at the distant end a state is assumed which is just the converse of the above. The electrostatic strain is annulled and the magnetic field correspondingly strengthened. This effect may be explained by considering, separately, the parts of the waves which appertain to each conductor as crossing each other at the centre of the loop. The opposing electric fields will annul one another whilst the magnetic being of the same sign will assist. A truer conception, however, would probably be that the lines of strain sink into the conductor, but the conductor is unable to dissipate the energy involved, and an augmented magnetic field results. This magnetic field then expands back along the circuit, and having a reversed direction of motion generates lines of strain of opposite sign. Briefly, the two types of reflection involved are:—

(*a*) Reflection from a disconnected extremity; the reflected wave suffers a reversal of magnetic field.

(*b*) Reflection from a looped extremity; the reflected wave suffers a reversal of the electric field.

Owing to the attenuated nature of the impulses which are reflected in a long telephone circuit, they produce little or no effect on transmission, but demand attention from the point of view of receiver efficiency, in that if completely reflected they would not deliver energy into the receiver, which would not therefore be actuated. The ideal receiving conditions are such that the energy of all waves which arrive is completely absorbed and efficiently applied to the production of articulate speech. Their complete absorption involves a judicious compromise between the terminal conditions for producing the two types of reflection referred to above.

Steady Current State.—In a short circuit, or any circuit of negligible resistance, on the other hand, the reflection of the impulses produces important and far reaching results on the whole process, and forms an essential feature of the primary stages of the establishment of a steady current. Indeed, it is not too strong a statement to make to say that until the processes about to be referred to, or their equivalents, are clearly pictured in the mind, a real physical interpretation of the nature of a steady current is not possible. This may sound a bold statement to make to electrical engineers who have been accustomed to the manipulation of electric currents all their lives, especially when applied to what has generally been regarded as the simplest of all states of current manifestations; but it is, nevertheless, true.

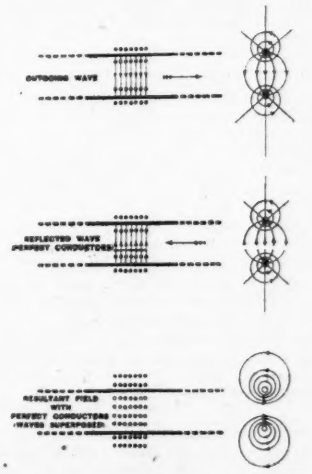


Fig. 23.

To appreciate the consequences of such reflection in a closed circuit, attention is first directed to the resultant effect produced by compounding outgoing and reflected impulses or waves (fig. 23.) For simplicity, the conductors which serve to guide the waves are assumed to have no resistance. The electromagnetic field of an outgoing wave is represented in the upper part of the diagram, whilst that of the same wave reflected from the end of the closed loop is shown in the centre. The reflected wave has a reversed electric field and a reversed direction of propagation. It, therefore, has a similar magnetic field. On compounding the two,

the electrostatic fields being equal and opposite will annul one another, the propagations being equal and opposite will also annul, and there only remains the magnetic fields, which are similar in both cases, and therefore assist. The annulment of the electrostatic fields involves a further augmentation of the magnetic field by reason of the energy released. This stage is depicted in the lower part of the diagram, where a steady magnetic field embraces each conductor.

Next consider a circuit connected to a source of steady E.M.F., the circuit and the source still having perfect conductivity. The compounding of outgoing and reflected fields will persist so long as energy is passed into the circuit from the source. The whole of the energy will so pass, and the result will be a steady magnetic field embraced by and linked to the circuit. Next, let the conductors assume resistance. The magnetic field will immediately commence to shrink upon them with dissipation of energy. The process of shrinkage will generate electrostatic lines of strain at right angles to the direction of shrinkage and to the magnetic field, which means self-closed lines of strain parallel to the conductor (fig. 24), which will usually, however, be very weak compared with

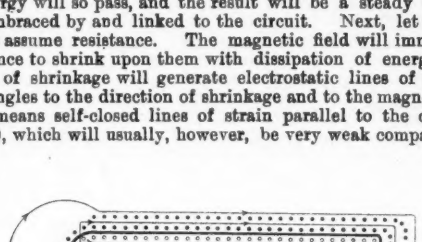


FIG. 24.

the magnetic lines of force. The existence of strain lines parallel to the conductor can be demonstrated experimentally, in the case of a Leyden jar discharging round a circuit, with suitable vacuum bulbs. To be precise, the electrostatic field would be compounded of these self-closed lines, together with transverse lines held by the capacity of the conductors, and other transverse lines generated by the source of E.M.F. and passed into the circuit. The main point insisted on, however, is that a steady current is, to all intents and purposes, a steady magnetic field embraced by and interlinked with the circuit. In an open circuit to which a steady E.M.F is applied, the converse effect of a steady electric field held by the conductors, is produced.

From this view of the nature of a steady current, it is interesting to observe how the much-debated question of the "velocity" of a steady (!) electric current becomes an absurdity. It has no velocity, or, at least, it tends to that state as the conductivity of the circuit approaches perfection. Otherwise, it will have a different "velocity" in every part of the circuit.

J. J. Thomson's "Tubes of Force."—The treatment of the electromagnetic field here adopted differs from that followed by Prof. J. J. Thomson, mainly in that the magnetic field is considered as a separate and distinct entity, while in Prof. Thomson's treatment the magnetic field is held to be due to positive and negative tubes of electrostatic force moving past one another in opposite directions. That is, he assumes that electric strain of both positive and negative direction can exist at one and the same time in the same place, and whenever this assumption is necessary on his method of treatment, it is held to constitute a magnetic field. Objection to this method may, perhaps, be taken on the ground that it is against dynamical principles to imagine that two equal and opposite resultant forces can have an actual existence in the same place at the same time. The idea appears to be a mathematical rather than a physical conception, and as a mathematical process it is, of course, quite accurate to assume that a point of no resultant force is equivalent to a point with two equal and opposite resultant forces, or, for the matter of that, with any number of equal and opposite forces. Something more definite than this appears, however, to be demanded for a working physical picture of the processes concerned, hence the method adopted in this paper.

The Electronic Theory.—It is now the fashion in treating of electrical theory to frame hypotheses and build up explanations based on the idea that the unit of "electricity," the ubiquitous "electron," has at last been unearthed, and henceforth renders all matters electrical plain and simple as A B C. From the point of view of extremists in the electronic theory of electricity, electric currents consist in the circulation of electrons along conductors, picking their way through the maze of atoms with lightning speed in the true sense of the word. Magnetic fields are, it is claimed, constituted of electrons whirling round orbits like so many planets in space.

These ideas have been primarily deduced from the investigations concerning discharges in vacuum tubes, from the laws of electrochemical action, from the experimental demonstration of the production of a magnetic field by rapid motion of a charged body, and last, but not least, from magneto-optical effects. It would trespass far beyond the limits of this paper to sketch out a sufficient history of the brilliant investigations which have led up to the proof of the existence of "corpuscles" forming an elementary sub-division of the atom of matter—a discovery of great and far-reaching import. To this extent the new theory undoubtedly possesses a substratum of truth, but like most new discoveries it has perhaps been over freely applied to the explanation of all phases of electrical action and manifestations. It has been freely acclaimed to be the unit, the elementary smallest particle of electricity, but it appears doubtful whether the mere fact of so naming it is not rather a danger than an assistance. As a "corpuscle" or "atomette" it has a useful function to perform, but as a unit of "electricity" it may yet be proved to have the reverse.

A perfect vacuum contains neither matter nor electrons, the latter, indeed, are rather an attribute of matter than of a perfect vacuum, of atoms than of ether. Electromagnetic fields are, on the other hand, a definite state of the ether, and can and do exist in the ether independently of either matter or electrons, in the form of self-closed lines; electrical manifestations without "electricity." The assumption of the existence of electrons, though it explains many of the relations between matter and electromagnetic fields, fails to explain the electromagnetic field itself, which is superior to the electron. Reference to the electric field of the electron is still necessary.

The conception of electrons in circulation along conductors carrying currents, which, while threading their way through the congested molecular systems of solid conducting material, are yet unable to move out of that material into the freer atmosphere of a surrounding gaseous dielectric or a surrounding vacuum, is puzzling. Further, this conception surely involves a definite "velocity" of propagation for a steady current; a result which is at variance with well-established laws. It further assumes, in the case of oscillating systems, an excessively rapid to and fro progression of electrons, or something equivalent thereto, along conductors. It is not difficult to show that if there is to be no difference of phase of the oscillations *at the conductor* (and it is difficult to see how any other assumption can be made), the electronic progression must be made at infinite speed, which appears to stultify the assumption of any such progression. Nor is the assumption at all necessary. One of the pitfalls into which a too free application of the electronic theory is apt to lead, arises from the very evident fact that attention to the hypothetical antics of the electron in the conductor will divert attention from the all-important functions of the dielectric medium. Very forcibly indeed will this apply to the practical electrician who has to adapt his ideas to the wave propagation involved in wireless telegraphy. The electron has been discovered in its right place in electrical theory, after the laws of propagation of electrical effects have firmly established themselves; it should also come last in its educational aspect so far, at least, as the science of electricity is concerned.

A New Type of Induction Motor.

By LOUIS J. HUNT, A.M.I.E.E.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Manchester, March 19th*, 1907.)

THE motor described in this paper possesses all the characteristics of the ordinary type of slip-ring induction motor, but differs from it in the arrangement of the windings. These are arranged to permit of the starting or regulating resistances being connected to the stator windings instead of to slip rings in the ordinary manner. The machine is an improved form of "cascade" motor, having two magnetic field systems super-imposed upon one another in the same core body. The second field has its origin in the rotor, and consequently induces secondary currents in the stator windings.

The machines already known may be roughly divided into two groups, the first including motors depending upon suitable spacing

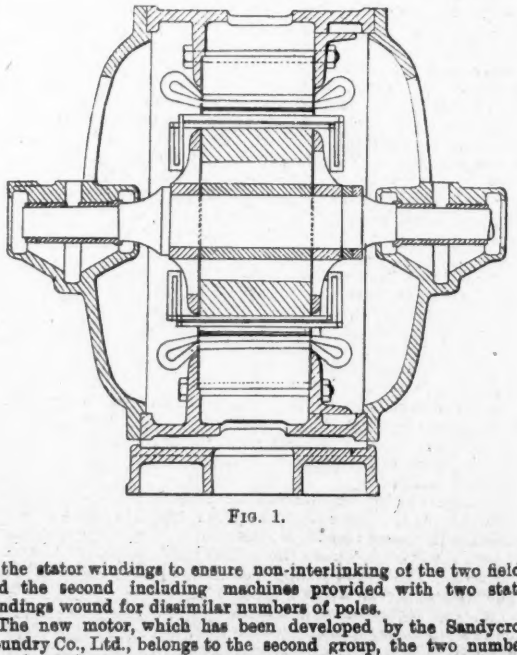


FIG. 1.

of the stator windings to ensure non-interlinking of the two fields, and the second including machines provided with two stator windings wound for dissimilar numbers of poles.

The new motor, which has been developed by the Sandycroft Foundry Co., Ltd., belongs to the second group, the two numbers of poles being so chosen that when divided by their greatest common factor the quotient is in one case an even and in the other

an odd number. This ensures non-interlinking of the two windings except by the agency of the rotor.

Fig. 1 shows the general arrangement of this motor, from which it will be seen that it closely resembles in design the ordinary type of machine.

The stator carries a single winding, and is provided with terminals for connecting to the supply mains, and with tappings which are connected in pairs through resistances whilst starting or when rheostatic speed control is desired, and are short-circuited at normal speed. The rotor is provided with a short-circuited winding without slip rings, unless designed to run at more than one efficient speed.

The chief difficulties to be overcome in the design of a "cascade" motor are greatly increased magnetic leakage and c^2R losses. Where two stator windings are used the inductance of the one occupying that portion of the slots farthest removed from the rotor is very large, owing to the increased leakage from tooth to tooth.

In experiments made on a motor wound with separate 8-pole and 4-pole stator windings, the former being placed nearest to the rotor, it was found that the leakage per ampere-turn per inch length of core (after deducting the leakage of the end connections) was 7·0 in the case of the 8-pole winding and 11·4 in the case of the 4-pole winding. The pole pitch of the 4-pole winding was, of course, twice that of the 8-pole, and if the conductors had occupied the position of the 8-pole winding, the leakage would have been certainly not more than 6·0 lines. By using one stator winding only, this difficulty was overcome, and experiments on the same motor showed that the power factor and overload capacity were much increased, although only two-thirds of the copper was used. The stator windings are parallel wound, and each pair of tappings connects two points of the winding between which there is no "primary" difference of potential. Fig. 2 shows diagrammatically a three-phase primary, six-phase secondary stator winding.

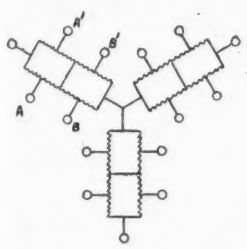


FIG. 2.

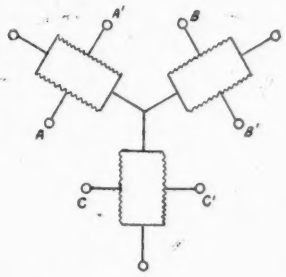


FIG. 3.

The mains are coupled to the three terminals of the "star" and the starting resistances, arranged for two-phase currents, are connected to the tappings A A′ and B B′. The remaining tappings are connected to a 4-pole switch mounted on the motor casing, and are short-circuited after the machine has reached its normal speed. This winding, although involving the use of a short-circuiting switch, is preferred for constant-speed motors, as the magnetic leakage and c^2R losses are rather less than would be the case if the windings were tapped for three-phase currents only. The currents in each branch are in quadrature. The resultant stator current is equal to the geometrical sum of the primary and secondary currents, and may be anything in value between 1·07 and 1·2 times the primary current. The arrangement of the windings and the power factor of the motor determine the actual value of the current. The stator c^2R loss is reduced by using a single parallel-wound winding instead of separate primary and secondary coils from 988 to 468 watts. The machine is wound for 12 poles, the primary field having 8 and the secondary 4 poles.

For motors designed for variable speed work, with rheostatic control, it is preferable to tap the stator windings for two or three-phase secondary currents, in order that the whole of the windings may be active during the time when the tappings are not short-circuited. Fig. 3 shows diagrammaticaly a suitable winding for this purpose. The tappings A, A′; B, B′; C, C′ are connected to three independent resistances.

Another form of winding, "mesh" connected, is arranged for three-phase tappings. This requires only six terminals, as three are common to both primary and secondary currents. The whole of the stator windings are not, however, active until the tappings are short-circuited.

A large number of different methods of winding the rotor are possible. It is important to keep the rotor c^2R losses as small as possible in order to ensure a high efficiency, and also to reduce the drop in voltage between the primary and secondary parts of the machine. The voltage drop has an important bearing on the performance of the motor as, omitting consideration of the inductance, the magnitude of the second flux depends upon it. If the CR drop be large, the overload capacity will be prejudicially affected.

The rotor may be provided with two separate windings, one wound for "x" number of poles and the other for "y" number of poles, the two being inter-connected. In this case the currents induced in the "x" pole winding flow into the "y" pole conductors, and produce the second magnetic field. It may be here stated that the objection raised to the two separate stator windings does not apply to the rotor, as the frequency of the currents is the same in both rotor windings. In fact, the local leakage lines are due to the resultants of the currents in the two sets of conductors, and by suitable arrangement the total inductance of the two windings may be made less than the sum of the inductances considered separately. Fig. 4 shows a rotor having two windings, one connected for 4 poles and the other for 2 poles. The former is "star" and the latter "mesh" connected. The 4-pole ampere-turns are consequently equal to 1·73 times the 2-pole ampere-turns. Only one slot per pole per phase is shown in the diagram.

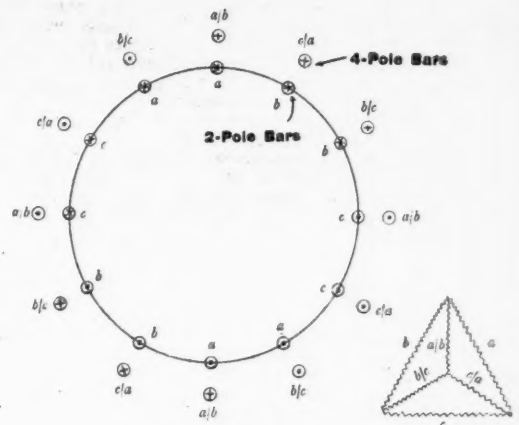


FIG. 4.

Instead of grouping the bars in two separate three-phase windings, the 4-pole and 2-pole conductors may be connected to form a winding, as shown in fig. 5. This arrangement reduces the length of copper required in the end connections, and has the same effect as two separate windings. The 2-pole bars are connected to form two "mesh" windings, as shown. Each 4-pole bar is connected at one end to a 2 pole bar, and at the other to a short-circuiting ring. There are two of these rings, one at each end of the rotor. Only the connections at one end of the rotor are shown; those at the opposite end are duplicates. The outside circle represents one of the short-circuiting rings. The inner ring of small circles are the 2-pole bars, the outer ring the 4-pole conductors.

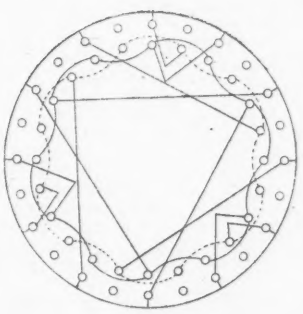


FIG. 5.

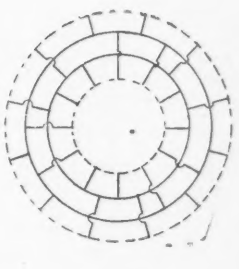


FIG. 6.

Fig. 6 shows this winding diagrammatically. The dotted circles are the short-circuiting rings, and the full-line ones the "mesh" connected 2-pole conductors. Each radial line represents a 4-pole bar.

A (4 + 2) pole winding has been shown, but it may be mentioned that as the resultant magnetic field is not symmetrical, a motor having this number of poles is not satisfactory. If, however, diagrams had been prepared for a larger number of poles, they would have been confusing when reduced to a small scale.

It has already been mentioned that the currents of the two rotor windings in any one slot, may be algebraically added together and considered as one current. By a suitable arrangement of the connections one winding may, therefore, be substituted for the two, and the total c^2R losses reduced to that of the "x" pole winding only.

The number of conductors and the total length of the end connections are equal to those of the 4-pole winding only. On the score of low copper loss this is a very good winding, but it has two serious faults; the slots are deep, owing to the concentration of the conductors, and the inductance, for the same reason, is considerably higher than that of the windings already described.

The rotor windings described are suitable for motors having one

efficient speed. Motors are being manufactured which may run at two, three or four efficient speeds, and it is clear that as these require the addition of slip rings, the number of phases for which the rotors may be wound must be limited to two or three.

A 12-pole motor having a rotor carrying 8-pole and 4-pole windings may, if fitted with three slip rings, be run at speeds corresponding to 12, 8, or 4 poles without losses in resistances. For a two-speed motor the connections are very simple, and especially is this the case if two rheostats are used. Fig. 7 shows diagrammatically the stator and rotor windings where the latter are of the type shown in fig. 4.

If the motor be wound for 8 and 4 poles and the periodity be 50 cycles per second, the two efficient synchronous speeds will be 500 and 750 R.P.M. The "mesh" connected rotor windings are wound for 4 poles, and the "star" windings for 8 poles. Slip rings are connected to the three terminals shown. The three stator terminals are connected to the mains, and the tappings are coupled in pairs by three resistances. As these resistances are cut out of circuit the motor speeds up until, with the tappings short-circuited, it reaches a speed approximating to 500 R.P.M. The three slip rings are now connected through resistances, and as these are cut out of circuit, the motor speed increases until it reaches 750 R.P.M., with the rings short-circuited. No current now flows through the stator tappings or into the 4-pole rotor winding. The motor will give an increased output, as the iron losses are less than when cascade-connected, and the copper losses are also much reduced.

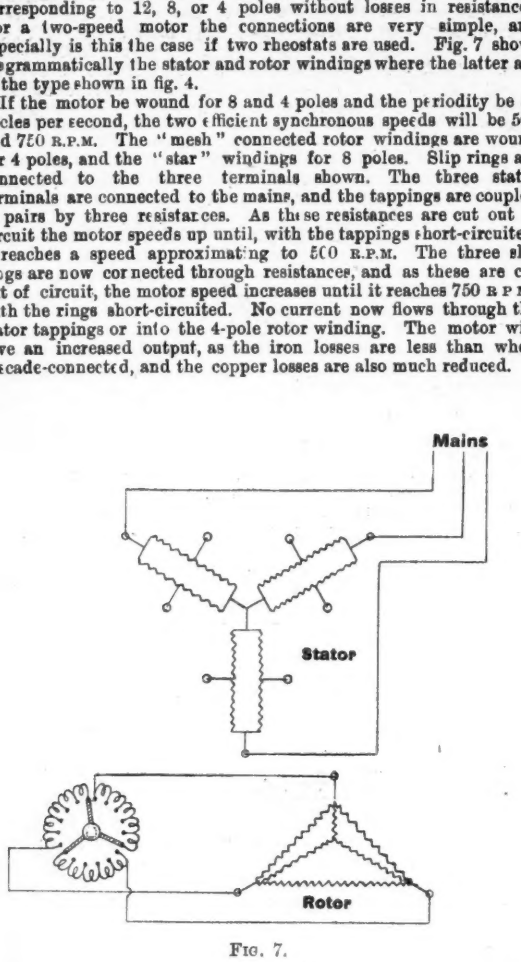


Fig. 7.

An alternative form of rotor winding is one with all the slots filled with conductors. The additional bars are connected to form a "star" winding, the terminals of which are attached to slip-rings.

In order to obtain three effective speeds, a change-over switch is necessary in the stator circuit. This enables the connections to be changed so that the primary currents may produce either an 8-pole or a 4 pole magnetic field. When connected for four poles, and with the slip-rings short-circuited, the motor runs at a speed of 1,500 R.P.M. The 8-pole rotor winding is now inoperative.

By the use of five slip-rings, the rotor connections may be changed so that both magnetic fields rotate in the same direction. The motor then runs at a speed corresponding to that of a machine wound for a number of poles equal to the difference between the numbers of poles of the two magnetic fields. For example, if the motor be wound for 12 and 8 poles, and used on a 50-cycle circuit, the following speeds can be obtained: 300, 500, 750 and 1,500 R.P.M.

If continuous, as well as alternating currents, be supplied to the stator windings, the motor runs at synchronous speed. The continuous-current leads may be taken to the tappings of one of the phases of the winding, or a parallel star winding may be used. In the latter case the continuous-current leads would be connected to the two neutral points of the "stars." The machine is started up as an induction motor, and when it has reached normal speed the continuous-current switch is closed. The motor pulls into step, no synchronising gear being necessary. There is no difficulty in starting against load. Several machines are nearing completion, and results of tests will shortly be published.

Discussion.

Mr. M. B. Field said the paper bristled with difficulties. The author referred to the "Cascade" system of connections, where the rotor of one motor was connected to the stator windings of a second motor; it was necessary that the motors should be mechanically as well as electrically coupled—a point which Mr. Hunt had omitted to mention. The author stated that if the machines had the same number of poles, and the windings were connected so that their magnetic fields rotated in opposite directions, the synchronous speed of the combination would be half the natural speed of either motor. He was unable to account for the directions of rotation which Mr. Hunt required. Mr. Hunt also said that if the motors had a dissimilar number of poles and were connected so that their fields rotated in the same direction, the speed of the combination would be equal to the difference of the independent speeds. This statement did not correspond with others in the paper. Taking the case of a Cascade system with a dissimilar number of poles, the synchronous speed could be determined as follows:—Let No. 1 motor have p_1 north poles, and No. 2 motor have p_2 north poles. Let the frequency of the supply current of the stator of No. 1 be N. The speed of the rotating field of No. 1 would then be $\frac{N}{p_1}$ revolutions per second—say, in the clockwise direction. They would call the speed of the rotor + or − m, the plus sign being taken for clockwise direction, and minus for counter-clockwise. The relative slip of magnetic field and rotor would then be $\frac{N}{p_1} \mp m$ revolutions per second. The frequency of the induced currents in the rotor of No. 1 machine was $N \mp m p_1$, and these currents were led into the stator of No. 2, which had p_2 north poles, and therefore the field rotated in No. 2 with a speed of $\frac{N \mp m p_1}{p_2}$. The rotor of No. 2 being mechanically connected to that of No. 1 rotated with a numerical speed of m revolutions, and, of course, the stator of No. 2 must be so connected that the field rotated in the same direction as the rotor. If this were not done, synchronism would be impossible, but, given this condition, synchronism would be attained when the numerical speed of the stator field No. 2, or $\frac{N \mp m p_1}{p_2}$, was equal to the numerical speed of the rotor, which was m. This gave the condition that the synchronous speed, m, was equal to $\frac{N}{p_2 + p_1}$. The direction of rotation of the magnetic fields, as he understood it, was just the reverse of what Mr. Hunt gave. In fig. 8

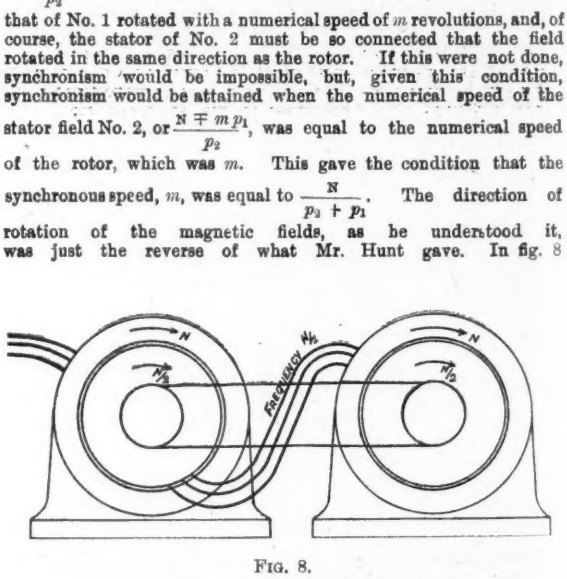


Fig. 8.

let them assume, as an example, that motor No. 1 was two-polar; motor No. 2 six-polar. When the two stator fields rotated clockwise, the synchronous speed corresponded to a combination having eight poles total, and when the two stators were so connected that the fields ran, one clockwise and one counter-clockwise, the speed of the combination would be equivalent to a machine having a total of four poles.

He was always under the impression that the essence of the Cascade system was to obtain two efficient speeds at least. Mr. Hunt had clearly indicated the very great disadvantages of the Cascade system; what was to be said in favour of a one-speed Cascade connected machine? Was it in any way a better machine than a 12-pole ordinary straightforward-wound motor? Was not the proper solution of the problem merely a mechanical one? The question of the interlinking of a winding of one number of poles with a field of another number of poles was interesting. Mr. Hunt stated that in order to give satisfaction, the numbers must be so chosen, that when divided by the greatest common factor the quotient in the one case must be an even number, and in the other case an odd number. On page 15, however, he stated that a four and a two-pole winding did not give satisfaction, although, according to the rules above quoted, the windings should not produce interlinking. It appeared, therefore, that the rule was not the only one determining the relative number of poles to ensure satisfaction.

Mr. Wilson said that assuming Mr. Hunt obtained the results, which he had taken more or less for granted in the paper, a motor of the type described would be a very great convenience, filling somewhat the same position that a double-commutator machine did in direct-current working; it gave a very large range of speed variation, with fairly efficient running. Had Mr. Hunt made any calculations of the power-factors of fairly large machines, and was the cost going to be very high?

Mr. Hunt, in reply, said that, with regard to Mr. Field's remarks referring to the Cascade system of coupling two motors, he must plead guilty to an error in the general statement as applied to two separate motors. The remarks as to relative directions of rotation of the two magnetic fields were strictly correct, when applied to the "Cascade" motor or to two machines, the rotor windings of which were inter-connected. When the rotor windings

of one motor were connected to the stator windings of the second motor, the conditions were obviously reversed. Mr. Field had referred to the use of a one-speed "Cascade" motor, and to the disadvantages of the "Cascade" system; the paper was intended to describe the means by which those difficulties had been overcome. The machine, as now developed, was as efficient as a slip-ring motor, and was cheaper to build. Control of the starting torque and speed was similar to that of a slip-ring motor, with the important difference that in one case, the resistances were connected to the rotor windings through slip-rings, and in the other case, to the stator windings. He thought it was generally agreed that slip-rings required almost as much attention as commutators, and mining engineers were particularly desirous of doing away with slip-rings wherever possible. By suitably arranging the rotor windings, it was found that the starting torque was constant for any position of the rotor. The construction was exceedingly simple and quite as mechanical as that of a squirrel-cage motor. The objections to two separate cascade-connected machines had been overcome in the motor described in the paper. He had worked out some approximate figures for a two-speed 200-B.H.P. motor wound for eight and four poles. The full speed, when run on a 40-cycle circuit, would be 590 R.P.M., and the second speed 394 R.P.M. At full speed and load the efficiency would be 93 per cent. At the lower speed the motor would give 150 B.H.P. with the same temperature rise and its efficiency would be 91 per cent. The motor would develop a starting torque equal to twice full-load torque, taking only 1·4 times full-load current. With full-load current it would develop about 1·45 times full-load torque. Comparing this machine with an ordinary slip ring motor, the same frame and stampings would be used, but there would be more iron in the teeth of the "Cascade" machine than in those of the slip ring motor. The core would be slightly longer, but the weight of copper would be about 150 lb. less. The cost of the two-speed motor would be less than that of the one-speed ordinary type machine. As to the use of a mechanical device for changing speed, he was everywhere met with the objection that what was wanted was a reduction and not an increase in the amount of gearing. Non-interlinking of the windings was not the only point to be considered in determining a suitable number of poles, because it was possible to choose numbers which would comply with this rule, but would give an unsymmetrical resultant field. In a one-speed motor any speed below synchronism could be obtained by inserting resistances between the tappings of the stator winding. In the same way, with a two or three-speed motor, any speed between the efficient speeds could be obtained by the use of resistances. Several motors had been built and tested, but the designs were not good, as the iron density was far too high and the copper density too low. However, before the paper was written sufficient data had been obtained to prove that machines having excellent electrical qualities could be built, and standard designs had now been prepared.

Physical Society.

At the meeting held on April 26th, 1907, Prof. J. Perry, F.R.S., President, in the chair, a paper on "Electrical Conduction produced by Heating Salts" was read by Mr. A. E. Garrett. The experiments described were divided into two series. The first, of a preliminary nature, consisted in testing a large number of inorganic compounds up to a temperature of 360° C. Several compounds, chiefly halogen salts, were found to produce easily-detected conductivity when heated. In the case of zinc iodide, conductivity could be detected at the ordinary temperatures of the laboratory. The second series was confined to special cases in order to ascertain the causes of the increased conductivity. It was found that in all the cases tried a formula of the form $i = a\,\theta^{\frac{1}{2}}\,e^{-\frac{b}{\theta}}$ where i = saturation current, a and b constants, and θ the absolute temperature, represented with fair accuracy the connection between the saturation-current and the absolute temperature.

Mr. W. B. Croft exhibited some solenoids which would move under the action of the earth's magnetic field. The best pattern for a solenoid is suggested by the moving coil of an electro-dynamometer. Two such were shown, which were conveniently worked by four dry cells in series. Each of these was hung with very thin metal strip by bifilar suspension, the strips being about 5 in. long and $\frac{1}{10}$ in. apart. There were also shown some wire models of magnetic lines approximately made to scale so as to represent the horizontal, vertical, and total lines of the earth; and a thick copper wire of 6·28 cm. radius, which will give a unit magnetic field at the centre when a current of 10 amperes is flowing.

Mr. W. S. Tucker read a paper on "The Influence of Pressure upon Convection Currents, and a criticism of J. Stark's relation between cathode fall of potential and temperature."

Mr. J. A. Tomkins exhibited a simple apparatus for mechanically illustrating the tangent and sine laws.

Publicity.—According to the *Western Electrician*, the Edison Electric Illuminating Co., of Boston, is seeking to increase its electrical business by inviting suggestions or hints from its consumers. A polite letter is sent out enclosing a stamped envelope for the purpose, and also a miniature booklet treating in non-technical terms of the metallised-filament lamp. Consumers are requested to send in suggestions or hints of any kind which will show the company how to improve its service in any way. We do not observe that any prize is offered for the best suggestions.

THE COST OF LIVING IN INDIA.

By C. H. SHANAN, Assoc.M.Inst.C.E., A.M.I.E.E., A.M.I.Mech E.
Municipal Electrical Engineer.

The Pagoda tree withered and died many, many years ago—it is as extinct as the Dodo; so that any young electrical engineer who thinks that he has only to come out here to shake down a fortune in a very short time, is doomed to disappointment.

About 30 years ago the rupee was worth 2s., and when exchange was favourable this was even exceeded. It is now permanently fixed at 16d., which represents a reduction of one-third of its purchasing value in respect of, at least, all imported goods, and it is on these that much of the Englishman's money goes. The cost, too, of indigenous foodstuffs, and of native labour in consequence, has gone up quite 150 per cent., owing to the improved facilities for exportation by land and sea. Taking these two important facts into consideration, it may safely be assumed that the cost of living in India has doubled within the last few years, and is still steadily on the increase. On the other hand, there is no corresponding increase in the salaries offered; in fact, these seem to be cut down more and more every year, at any rate as far as electrical engineers are concerned.

Then there is the formidable rivalry of the natives of the country to be considered. It is usual for the average Britisher to class all black men as "niggers"—animals not to be taken notice of; but the native of India may well be left out of this. Cheap and good education and training in Government colleges and technical institutes have spread well-qualified civil, electrical, and mechanical engineers broadcast over the country. In the lower grades the Indian is rapidly replacing the European, and it is only a question of time for him to have a very good chance against the imported man. At the Imperial Assemblage at Delhi, where most of the Indian chiefs were present, the Gaikwar of Baroda had an excellent installation in his camp, all of which was erected and worked by natives. The native of India is a most adaptable man, and when the country is opened out more from an electrical point of view, he will prove a dangerous rival. It is necessary to bear these facts in mind in relation to the cost of living out here, for the Indian can thrive and maintain a family comfortably on a sum that the European spends on his personal servants alone.

I will come now to the actual cost of living in the three large cities of India—Calcutta, Bombay and Madras. The new-comer, if he were single, would ordinarily be compelled to live in a boarding-house or hotel, the minimum charges of which would be £10 a month. He would have to keep a personal servant on £1 a month, a "dhobie" (laundryman) on 10s., and pay extra for his electric light and fans—say, £12 for bare living, with no luxuries or incidental expenses. In these large towns "chummeries" are very popular. A few men rent a house, engage servants, and manage housekeeping on their own account, sharing expenses every month. When the right sort get together it is a pleasant way of living, though perhaps no more economical than the other.

For the married man it is different. A small flat in Calcutta costs from £8 to £10 per month, and is not easy to get even then. The following servants must be kept: cook, kitmagar (butler), bearer, sweeper and dhobie. It seems a lot, but no Indian servant will do anything except his own particular work. The wages of these men will come up to from £4 to £5 a month. Then everyone keeps a horse and trap, the maintenance of which costs £3; board will be another £7, thus bringing up the total to from £22 to £25 per month, and, as in the former case, this does not include luxuries or incidental expenses.

Up-country stations are just as expensive, especially for the single man, for very few have hotels, and practically none have any boarding-houses. The young electrical engineer will therefore have to rent a house, engage at least six servants, and keep a horse and trap. Under these circumstances it will cost him at least £15 a month for bare living.

After the above come the hill stations, and these are the most expensive of all, though they are, as a rule, full of

boarding-houses and hotels. It is almost impossible to convey any idea of an Indian hill station to the stay-at-home Britisher in less than a column, and I doubt if the Editor would allow this. The conditions of living are much like other parts of the country, but incidental and other expenses more than double themselves.

It is not, however, the bare living expenses in India that should be taken into account. I assume that the young electrical engineer coming out here is a gentleman, and as such must maintain his position. India is a peculiar country. Except in the three large cities, society is composed almost wholly of Government officials who live up to, and even beyond, their pay, relying on a comfortable pension at fifty-five years of age. The electrical engineer must be in the swim; he must be a member of the local club and join in everything that is going. If he doesn't it means total extinction socially—the mixing with Eurasians and such like. As a professional man who takes a pride in his profession, this is an impossible position. Then he has no pension to look forward to; he dies in harness, or with his boots on, as the Americans put it; so that besides his living expenses plus incidentals, he should be assured of something to save before he thinks of coming out.

I have, more or less, a life-long experience of the country, and can honestly advise no man to come out here unless he secures at least three times the salary he is getting at home. You can live much more comfortably in England on £200 a year than you can on £600 in India, and have a far better time as well. Young men are anxious, however, to see a new country, which is only natural, but I strongly advise no one to come out here on less than £25 a month—this is a minimum salary. To the man at home some of the items given above may appear unnecessarily extravagant, but he will soon learn that what are regarded as luxuries in England are absolute necessities in India.

It is almost hopeless to write about the climate. India is a continent rather than a country, and the assorted climates are worthy of a surprise packet. As I write now there is a foot of snow outside and it is still coming down, whereas the man in Bombay is very likely sitting in a long chair at the Yacht Club, in the thinnest of silk suits, drinking an iced peg and swearing at the heat. Except in the hill stations the summer is very trying and enervating.

There is no necessity for the newcomer to burden himself with a large outfit. He can get everything he requires on the spot to suit the climate of the place he is in. A few well-cut suits by a good tailor, a rifle, gun and camera are really all a man needs to bring out.

There are, I believe, over two hundred languages and dialects in India, but thanks to Akbar there is a more or less universal one that will see a man through. It is called Urdu and is the *lingua franca* of the country. It is easy to learn colloquially, and every engineer coming out should try and acquire it as soon as possible. "Forbes's Manual" is a very useful book for this purpose.

In conclusion, I would not advise any one to come out here on speculation, as I know of no country where the stranded European fares worse—he is shunned by his own countrymen and despised by the natives.

The following communication, which we have received from a resident in India, contains many interesting particulars, and, we think, will be appreciated :—

In India one must divide the Europeans into two broad classes—the sahib and the chota sahib. The chota sahib is the man who comes out here as a shop foreman, engine driver or to similar subordinate situations, which in England are usually filled by workmen who have shown their ability, and have risen to responsible positions. This class of man in India can lead a very different sort of life to the sahib; he usually lives in a cheap part of the town, where Eurasians and better-class natives live, and he has but few social expenses. In cities, such as Calcutta or Bombay, such a man can easily live on Rs. 100 to Rs. 150, though with such a pay he would not be able to save much money, if any. If married, he should receive at least Rs. 250 a month. Up country living for such people is very cheap, and a married man with quarters, which are usually supplied either free or at a nominal rent, can live comfortably on Rs. 150.

Living for the sahib is a very different matter. The standard of living in India has been set absurdly high, and, in order to be in the swim, it is necessary to live up to the standard. Firms bringing out assistants expect them to live in good quarters and to mix with society, and to make themselves as popular as possible. A very large proportion of business is the result of personal friendships, and the most popular men are invariably the most successful business men. Nearly every man coming out desires to be a member of one or two clubs, to keep a horse for riding, or a horse and trap for driving, to play tennis, cricket or football, for in India, unless healthy recreation is indulged in, one is certain to fail in health. In towns in India, the usual form of living is in boarding houses, where the cost of living varies from Rs. 150 to Rs. 200, dependent on the house and the size of room. In addition to this, servants are necessary, and wages for these amount in all to about Rs. 30 a month, including the dhobie or washerman. Walking in this hot climate is out of the question when travelling to and from the office, and ghari hire accounts for at least Rs. 30 per month, making in all a total of Rs. 210 to Rs. 260, and this is for bare living only. When club subscriptions, club bills and entertaining are taken into account, Rs. 300 to Rs. 350 is a moderate estimate, and includes nothing in the way of clothing, evening entertainments, such as theatres, concerts, &c., or income tax and numerous other calls, such as subscriptions, &c.

At present well-known firms are bringing out men on Rs. 250 to Rs. 300 a month, and expect them to live decently on it; in fact, I know of one firm who remonstrated with one of their assistants who had come out on a small salary, and who, to save money, took a cheap room in the poor quarter of the city.

I myself came out to India on Rs. 350 a month, rising by Rs. 50 a month to Rs. 450 in three years; during the whole time it was a hard fight to make both ends meet, and, needless to say, at the end of the three years I had saved no money at all.

My advice is that no man should come out to India to employment in any of the large towns on any salary less than Rs. 350, and even then he will need to live very quietly, and cannot hope to take part in all that is happening around him; but if a man desires to keep his horse and live as other people do, Rs. 450 will barely enable him to do so. In all the above remarks no word has been said about contingencies, such as sickness; and when a doctor's fee is Rs. 16 per visit, any serious illness is a heavy expense, and many a man has run into debt over such a matter. Some firms provide medical attendance, and such an action is only right in a climate like that of India.

All the above mostly concerns living in large business centres, and living in the mofussil is quite a different matter. Living and houses are cheap, and a salary of Rs. 250 may often be found quite sufficient for a single man, although it would scarcely allow him to save money, but any pay above this figure should represent a clear saving.

In conclusion, a word regarding an outfit may be suitable, and my advice is, "don't buy an outfit at home." Bring out a decent light serge or flannel suit or two, a dress suit and a dinner suit, and just as much in the way of underclothing as you will need on the voyage, but leave all light cotton and silk suits, topee, thin underclothing, shirts, &c., till you get to India, where you will find that you can buy them as cheap as, if not cheaper, than at home; and at the same time you will buy what is actually being worn and what is specially made for India. High-class tailoring is rather expensive here, though good clothes can be bought when required, but to the average man one or two good suits, brought out with him, will last him till he returns home on leave, for one doesn't wear good suits to any extent, the usual custom being to wear thin cotton checks, Assam silks or Russian crash suits for office, and a good suit for an evening drive or for calling.

[An article on this subject appeared in the ELECTRICAL REVIEW for March 8th, 1907].

THE DIVINE AFFLATUS.

MINTO, in his "Prose Composition," very cogently observes that a man may have the most complete knowledge of how not to write, and yet dip his pen and cudgel his brains in vain.

It has therefore occurred to me that some reflections upon the difficulty of finding an inspiration may be of use to would-be writers, and at the same time I will try to arrange that they do not form an incentive to the numerically large class of talking drivellers to commit their pifflings to paper.

Much has been heard, at all times, of "rushing into print," and true it is that many people do that without due thought, as reference to the "Correspondence" columns of nearly all our newspapers will show. It is a tendency of the human mind to voice its thoughts, without necessarily giving consideration to what other and wiser minds have voiced before it. This explains, to a very large extent, the enormous amount of rubbish that constantly comes down, with so little that is of any use, under the name of "technical literature," against which "W. M. M." so ably inveighed in the ELECTRICAL REVIEW a few weeks ago.

We often find, on the other hand, that men who have a real knowledge and grip of their subject are debarred from setting their experience into written words for fear that others may jeer at their style, or lack of it: that their work is so ordinary that it is not worth anyone's while to listen to anything about it: that it may be rejected, with less or more of kindness and more or less of scorn, by those to whom they offer it: and that others may be displeased by their presumption. To such one must hold out an inviting hand, and their effusions, edited if necessary, ought to be launched upon a waiting world.

The man who deems it necessary to write papers for institutions, associations, or whatever other scientific or pseudo-scientific bodies he may chance to belong to, often writes for the sake of writing. Or perhaps by virtue of the position he may hold, the organising committee of such a body, suffering, as usual, from a dearth of material, may ask him to read a paper, and he, either in a weak moment or from a genuine desire to improve the world by bringing out his light from under its habitual bushel, may consent to do so. Then comes the pen-dipping and brain-cudgelling exhibition referred to in the opening paragraph of this monumental article. He cannot find a subject; finding one, he cannot tell where to begin. He thinks of his audience, and probably finds that it is of a very mixed order. He must not be too elementary, or the better part will go to sleep through boredom, and he must not be too recondite, or the other part will go to sleep rather than be bothered with his profundity. He tries to avoid treading on people's toes, and the result is milk-and-watery; wishing to keep clear of so unappetising a beverage, the result is humour (!) of so evanescent a type that it is like flat soda-water, worse than ever.

So he sets to work as methodically as he can, and writes up his article or paper in a systematic way, and puts down his headings in order, and twists up everything very neatly at the beginning and the end, like a Scotch minister with a sermon, or a butcher with a sausage—and now the resulting paper is so dry that nobody gives it any attention, unless they are personal friends—or enemies—of his own. Probably his local paper is content with a passing notice of his work, and does not give him the column-and-a-half with which he hoped to awe the town. He has not grasped fame, but he has tasted blood. He wants to write again, but finds he has written all he knew of the one thing about which he knew anything, so the brain-cudgelling is more prolonged than ever, with even poorer results.

The habit should be cultivated of making intelligible notes, and filing them in such a manner that they can be referred to at any time. Then, by-and-by, when any subject attracts attention, the owner ought to be able to find what he knows about it, and to write up his knowledge in an attractive and useful form. There is no doubt that the publication of notions aids advancement, while we admit and deplore the bulk of balderdash to which notoriety is afforded.

The divine afflatus is not a hardy perennial, nor does it spring into being as does the pot of geraniums from the conjurer's silk hat. It is a hot-house plant, and needs careful cultivation. It pays to give it that cultivation; close reasoning, which is a very desirable feature of all writing, though frequently conspicuous by its absence, is greatly aided thereby. C.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

19,805A/06. "Improvements relating to receivers for wireless telegraphy." A. ARTOM. (Date applied for under Rule 5 of the Patents Rules, 1905, September 5th, 1906.) April 24th. (Complete.)

9,270. "Improvements in or connected with automatic electro-magnetic sanding gear and foot sanding gear for use on electric railway and tramway vehicles." M. CUMMINS. April 22nd.

9,288. "Improvements in commutators and distributors for electric ignition apparatus." H. C. L. HOLDEN and G. K. B. ELPHINSTONE. April 22nd.

9,294. "Improvements in automatic electric switches." H. C. L. HOLDEN and G. K. B. ELPHINSTONE. April 22nd.

9,301. "Improvements in devices for supporting the insulation of cables." S. W. MARTYN. April 22nd.

9,303. "Improvements in or relating to press-button closing devices." F. WIESE. (Date applied for under Patents Act, 1901, April 23rd, 1906, being date of application in Germany.) April 22nd. (Complete.)

9,333. "Improvements in telephonic apparatus." E. A. GRAHAM. April 22nd.

9,337. "Improvements in electrolytic electricity meters." B. NORTH and R. POHL. April 22nd.

9,339. "Improvements in gloves for use in household, electrical, hospital, chemical and other work." K. C. SHARP. April 22nd.

9,345. "Improvements relating to electric pendant lamps for indoor lighting and for other services." T. ELLIOTT. April 22nd. (Complete.)

9,355. "Bearing for the upper end of the shaft of an electric motor-meter." ALLGEMEINE ELEKTRICITATS-GES. (Date applied for under Patents Act, 1901, September 14th, 1906, being date of application in Germany.) April 22nd. (Complete.)

9,358. "Improvements in conduit threaders." J. C. DIETER, S. BOWSHER, and E. DAVIS. April 22nd. (Complete.)

9,390. "Improvements in electric vehicle or locomotive brakes." J. F. SIMPSON. April 23rd.

9,397. "Improvements in and in the manufacture of insulating or non-conducting materials for electrical purposes and otherwise." S. DE PONT. April 23rd.

9,434. "New or improved combination electric fuse and switch." V. MAINPRIZE. April 23rd.

9,451. "Improvements in electric ignition for internal combustion engines." F. W. LANCHESTER. April 23rd.

9,461. "Improved method of operating primary batteries." J. DE TORLEY and E. BENKO. April 23rd.

9,463. "Improvements in electrolytic electricity meters." B. NORTH and R. POHL. April 23rd.

9,477. "Improvements relating to primary batteries." H. W. LAKE. (C. E. Hite, United States.) April 23rd. (Complete.)

9,483. "Improvements in incandescent electric lamps." P. G. TRIQUET and J. J. BARROLLIER. April 23rd. (Complete.)

9,491. "Improvements in and relating to electric motor controllers." ALLGEMEINE ELEKTRICITATS-GES. (Date applied for under Patents Act, 1901, April 27th, 1906, being date of application in Germany.) April 23rd. (Complete.)

9,498. "Improvements relating to electric arc lamps." D. SUCHOSTAWER. April 23rd.

9,499. "Improvements in and relating to current-loop for electric arc lamps." DEUTSCHE BECK-BOGENLAMPEN GES. m.b.H. and H. BECK. (Date applied for under Patents Act, 1901, December 21st, 1906, being date of application in Germany.) April 23rd. (Complete.)

9,515. "Improvements in insulators for telegraph poles and the like." BULLERS, LTD., and E. H. CHAMBERS. April 23rd.

9,554. "Improvements in dynamo-electric machines." C. A. MUDGE. (Date applied for under Patents Act, 1901, August 24th, 1906, being date of application in United States.) April 24th. (Complete.)

9,562. "Improvements in and relating to ignition devices." D. E. BARNETT (usually known as A. D. Barnett). April 24th.

9,572. "Improvements in and relating to the manufacture of electric lamps having incandescing bodies of metal." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 24th.

9,576. "New or improved method of, and apparatus for, starting electro-motors and regulating their action." F. THURSFIELD. April 24th.

9,585. "Improvements in brush-holders for dynamos and electric motors." S. M. GREAVES. April 25th.

9,591. "Improvements in means for guiding and supporting carbons, or electrodes in pairs in arc lamps." O. GROSS. April 25th.

9,623. "Improvements in insulated couplings or hangers for electrical purposes, in connection with surface contacts for electric traction. W. J. VANSTONE. April 25th.

9,636. "Process for recovering chromic acid from solutions of sulphate of chromium in an electrolytical manner." CHEMISCHE FABRIK BUCKAU. (Date applied for under Patents Act, 1901, May 8th, 1906, being date of application in Germany.) April 25th. (Complete.)

9,637. "Process for increasing the durability of carbon and graphite electrodes in aqueous solutions." CHEMISCHE FABRIK BUCKAU. (Date applied for under Patents Act, 1901, May 8th, 1906, being date of application in Germany.) April 25th. (Complete.)

9,652. "Improvements in and relating to electric switches." P. WATSON April 25th.

9,674. "Improvements in means for preventing direct contact of the ear with telephone receivers." H. J. HADDAN. (M. Ratignier and the firm of H. Peroilhac et Cie.) April 25th. (Complete.)

9,682. "Improvements in microphones." J. T. KNOWLES. (E. H. Stolz, United States). April 25th.

9,683. "Improvements in voltage regulators." S. B. STORER. April 25th. (Complete.)

9,684. "Improvements in wire coating machines." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 25th.

9,685. "Improvements in and relating to supports for the filaments of incandescent electric lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 25th.

9,689. "Improvements in incandescent lamps." J. SWINBURNE. April 26th.

9,701. "Improvements in the construction of electric motors and dynamos." F. MORRIS. April 26th.

9,705. "Improvements in controlling systems for electric railways." W. Arthur. April 26th.

9,720. "Improved telegraphic code." C. Herbst. April 26th.

9,726. "Improvements in constructing antennæ of wireless telegraphy." J. Murgas. April 26th. (Complete.)

9,743. "Improved means for locking electric switch boxes." C. A. Day. (Paul Meyer Akt.-Ges., Germany.) April 26th. (Complete.)

9,747. "Improvements in electric tell-tale indicators." J. J. Stockall, Jun., and T. J. Stockall. April 26th.

9,748. "Improvements in and relating to switches for electric circuits." J. J. Stockall, Junr., and T. J. Stockall. April 26th.

9,761. "Improvements in thermo-mercurial contact makers for fire-alarm and other purposes." N. M. Ogle. April 26th. (Complete.)

9,791. "Improved timing wheel device for valves and magnetos used in conjunction with internal combustion engines." B. C. Brazier and B. J. Brazier. April 26th.

9,794. "Improvements in heads for the trolley poles of electric tram-cars and like vehicles." J. Green. April 27th.

9,833. "Improvements in and relating to telephone systems, and apparatus therefor." H. R. Turner. (Date applied for under Patents Act, 1901, May 12th, 1906, being date of application in United States.) April 27th. (Complete.)

9,850. "Improvements in measuring instruments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 27th.

9,851. "Improvements in maximum demand electric indicators." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 27th.

EXPIRING PATENTS.

(*Concluded from page* 748.)

22,570. "Railway points and signals." Siemens Bros. & Co., Ltd., of Middlesex. (Siemens & Halske, Berlin.) November 24th, 1893. Relates to apparatus for electrically operating switches, and consists in means for locking the switch if a train is near, for cutting the circuit to the semaphore if a train has forced open the switch, and for placing a signalling device near the switch so that orders can be transmitted thence to the central station. The switch apparatus at the central station consists of a double-contact switch, an electro-magnet working an indicator and a second electro-magnet working an indicator, and a contact-switch which works the semaphore circuit. A catch holds the first indicator in a central position if a current of short duration passes. A locking rod secures the double contact-switch when the electro-magnet is excited, or when a second magnet is not excited. The points are worked from a crank disk connected by a shearable pin to a toothed ring driven by worm-gearing from an electro-motor which has four brushes and is placed on a three-wire circuit. At the completion of the stroke a cam on the crank disk acts on a lever which is connected to a three-armed lever, this throws off two of the brushes of the electro-motor, and lets the others on for the reverse strcke. The motion of the three-armed lever is limited by stops on the armature, but these stops are out of action if no current is passing, so that a train forcing open the switch breaks a pin, and the lever connections lift a third of the brushes of the electro-motor to break all the circuits. Lengths of rails against the switch are insulated and so connected that a vehicle standing on them causes a current to flow through a magnet and operate a locking bar. Two other conductors connect these rails to a signalling apparatus, from which a current of short duration can be sent so as to move the first indicator into the central position.

22,863. "Dynamos, &c., regulating." H. H. Lake, of Middlesex. (Thomson-Houston International Electric Co., Boston, U.S.A.) November 28th, 1893. Relates to a method of regulating the current through the field coils of dynamo-electric generators and motors, which are compound-wound and connected to the mains in parallel, the object being to enable any one machine to be regulated without affecting the others. The machines are connected in the usual way; an equalising connection is made between the brushes to which the respective series windings are connected. A portion of the series winding of each machine is shunted by a suitable adjustable rheostat so that the current through the series coil of any machine may be regulated without appreciably affecting the others. There may be a variable resistance in series as well as in shunt with the field coil, one of these resistances being diminished while the other is increased so as to maintain a constant resistance between the terminals.

23,083. "Electric meters." H. Aron, of Berlin. December 1st, 1893. Quantity and energy meters of the electrically-controlled clock type. Consists in means for preventing inaccurate records due to irregularities in the normal speed of either of the clock trains. This is effected by a commutator which, at predetermined intervals, changes the direction of the current in one-half of the measuring system, and a mechanical reversing device, which at the same time reverses the direction of motion of the recording train.

23,309. "Dynamo-electric machines." H. Hutin, of Paris, and M. Leblanc of Le Raincy, France. December 4th, 1893. Relates to continuous-current generators and motors, and has for its objects (1) to prevent the occurrence of Foucault currents in the field magnets of dynamos having armatures of the Pacinotti kind; and (2) to avoid in machines having any form of armature, the effects resulting from the breaking of a circuit or a sudden variation in the load. Consists in applying to the polar enlargements of the field magnets closed circuits, termed "deadening" circuits, composed of two rings of non-magnetic metal connected together by suitable bolts of the same material, extending across the concave polar surfaces.

23,902. "Electrically-operating railway signals, &c." W. P. Hall, of U.S.A. December 12th, 1893. Relates to means for utilising an ordinary rotary electromotor in the operation of railway signal arms or semaphores, railway gates, railway switches, and other devices, which are to receive a definite movement upon the breaking or closing of a circuit, or upon the happening of some event, such as the approach or recedence of a train. Consists essentially in a suitable form of gearing connected at its fast end by a centrifugal clutch to the electromotor, and at its slow end to the device to be moved, and a switch connected to the moving mechanism for cutting off the current from the electromotor and applying an electrically-operated brake at the completion of a definite movement. When the apparatus is employed for operating a railway switch, the electromotor drives a second shaft formed with a screw-thread, upon which travels a nut connected to the moving tongues of the switch. A reversing switch is placed in the battery circuit, and a second switch operated by the moving nut in the electromotor circuit, the latter breaking the circuit at the end of each movement.

24,254. "Electric switches." F. H. Nalder, C. W. S. Crawley and A. Soames, of Middlesex, and H. Nalder, of Beckenham. Switches for automatically connecting two circuits when the potential of one shall exceed that of the second. The switch is especially applicable to the charging of secondary batteries. A solenoid in the battery circuit has a pivoted core, which is constantly magnetised in one direction. To this pivoted core is attached a lever, which is able to make or break the main circuit (through which the battery is charged) between two mercury cups. A second solenoid with a fixed core arranged adjacent to the first has two windings, one excited by the battery and one by the dynamo. Thus the sign of magnetisation of the core of this solenoid will vary according as the battery or the dynamo has the higher E.M.F. The core will, therefore, attract or repel the pivoted core of the first electro-magnet, so making or breaking the battery circuit.

24,274. "Electrolysis, &c." C. Kellner, of Vienna 1, Austria. December 16th, 1893. Relates to apparatus in which mercury is used as cathode. Mercury is supported on a porous bottom of pots with glazed sides, which are carried by a cover. The anodes of carbon, or other conductor which withstands the action of the anion—such as chlorine—may be disposed alongside or beneath the pots. A current for outside work may be obtained by inserting in the reaction liquid in the pots an additional electrode connected to a conductor. A secondary cell is thus formed in which the energy of the chemical reaction between the cation and the reaction liquid in the pots is utilised.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1905.

Ignition Gear for Internal Combustion Engines. G. Johnston and T. Wardell. 27,276. December 30th.

1906.

Short-Circuiting Overhead Electric Conductors or Cables. E. Giraud. 21,945. October 24th. (Date applied for under International Convention, October 6th, 1905.)

Electric Arc Lamps with Convergent Carbons. F. Ruzicka. 23,851. October 26th.

Dynamo-Electric Machines. H. G. Reist. 23,951. October 27th. (Date applied for under International Convention, October 27th, 1905.)

Windings for Dynamo-Electric Machines. H. W. Storer. 25,206. November 8th. (Date applied for under International Convention, November 18th, 1905.)

Process of Electrolytically Extracting Metals from Ores. 25,489. M. Perreur-Lloyd and A. M. Gardner. November 12th.

Telegraphic Transmitters. R. Wolters. 26,256. November 20th.

Comparison or Standardisation of Electrical Measuring Instruments. M. Kallmann. 28,049. December 8th. (Date applied for under International Convention, May 17th, 1906.)

Regulation or Control of Electric Motors. Johnson-Lundell Electric Traction Co. and J. G. V. Lang. 176. January 2nd.

Method of and Means for Obtaining and Working Electric Currents of High Periodicity. S. G. Brown. 226. January 3rd.

Wireless Telegraphy. L. de Forest. 5,258. March 3rd.

Dynamo-Electric Machines. W. Siebert. 7,961. April 3rd.

Telegraphs for Transmitting Orders. Siemens Bros. & Co. and E. F. H. H. Lauckert. 8,340. April 6th.

Accumulators. E. de Marcay. 8,345. April 6th. (Date applied for under International Convention, January 24th, 1906.)

Electric Distance Switch. A. H. Leibius. (T. F. G. Leibius.) 8,616. April 10th.

Apparatus for the Electric Ignition of Internal Combustion Engines. A. H. Nicholson. 8,651. April 10th.

Dynamo-Electric Machines. British Thomson-Houston Co. and W. F. Dawson. 8,932. April 12th.

Apparatus for Automatically Operating Electric Switches at any given Intervals. M. W. W. Mackie. 9,191. April 18th.

Electric Fuse Boxes and the like. A. Eckstein and A. C. Heap. 9,227. April 19th.

Electrically-Operated Valves. Elektricitäts Akt.-Ges. vorm. W. Lahmeyer and Co. 9,509. April 23rd. (Date applied for under International Convention, May 3rd, 1905.)

Apparatus for Starting and Reversing the Direction of Motion of Electro-Motors Actuating Elevators, Hoists and the like. A. Jensen, H. J. Norballe and J. L. Lawson. 10,613. May 5th.

Manufacture of Incandescence Bodies for Electric Lamps from Tungsten Compounds. British Thomson-Houston Co. (General Electric Co.) 11,409. May 16th.

Appliances for Facilitating the Climbing of Telegraph Poles and other Poles or Standards. E. J. Chambers. 12,196. May 25th.

Windings for Dynamo-Electric Machines. E. C. Lamme. 12,491. May 29th. (Date applied for under International Convention, June 2nd, 1905.)

Electric Switches. A. White. 13,602. June 13th.

Electric Accumulator Plates. N. Terry. 13,731. June 15th.

Separators for Secondary Battery Plates. H. H. Lake. (Rhode Island Electromobile Co.) 15,237. July 4th.

Electric Insulators for High-Tension Conductors. H. H. Lake. (G. Semenza.) 18,408. August 16th.

Electric Motor Control Apparatus. G. W. Euker. 18,957. August 24th. (Date applied for under International Convention, August 31st, 1905.)

Controllers for the Trolley Poles of Electric Cars. H. J. Edwards. 19,150. August 21st.

Device for Regulating or Controlling the Pressure of the Current in an Electric Circuit. J. Watkinson and A. E. Payne. 19,219. August 28th.

Apparatus for Producing Oscillatory Electric Currents. P. C. Hewitt. 21,767. October 2nd. (Date applied for under International Convention, October 9th, 1905.)

Electrical Measuring or Indicating Instruments. H. P. Davis and P. MacGahan. 22,498. October 11th. (Date applied for under International Convention, October 21st, 1905.)

Aerial Conductor Arrangements for Wireless Telegraphy. W. P. Thompson. (Ges. für Drahtlose Telegraphie.) 22,779. October 15th.

Device for the Prevention or Mitigation of the Skidding of Vehicles Propelled by the Power of Petrol, Steam, Electricity, or any other Motive Power. A. F. Wileman. 25,380. November 10th.

Frequency Changers for Electric Currents. J. E. Noeggerath. 26,990. November 27th. (Date applied for under International Convention, December 4th, 1905.)

Manufacture of Dynamo Brushes, Sliding Contacts or the like from Carbon. Geb. Siemens & Co. 27,499. December 3rd. (Date applied for under International Convention, February 16th, 1906.)

Electrical Clocks. Aktiebolaget Svenska Elektriska Urfabriken. 27,714. December 5th. (Date applied for under International Convention, December 6th, 1905.)

Tool for Examining Electric Conductors. A. Scheibler. 29,545. December 28th.

1907.

Mechanical Organs or Pianos Provided with an Electric Lighting Arrangement for Producing Luminous Effects. C. Marenghi. 217. January 3rd.

Electrical Transformers. S. E. Johannesen. 4,227. February 20th. (Date applied for under International Convention, March 3rd, 1906.)

Current Collecting Devices for Electrically-Propelled Vehicles and the Like. T. Varney. 494. January 8th (date applied for under International Convention, January 16th, 1906).

Electric Signalling Installations. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 1,293. January 17th.